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PUBLICATION OFFICES:
168–177 POTTER BUILDING, NEW YORK.
Telephone Call: Murray 586. Cable Address: "Electrical," New York.
New England Office, 48 Congress Street, Boston.
Western Office, 44 Lakeside Building, Chicago.

W. J. JOHNSTON, Editor and Publisher.
T. COMMERFORD MARTIN, JOSEPH WETZLER, Associate Editors.
E. P. THOMPSON, Associate Editor Patent Department.
CLARENCE E. STUMP, Business Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.00.
(Postage Prepaid in the U. S. or Canada.)

CLUBS.—In clubs of 4 or more, $2.50 a year each; with a free extra copy to the getter-up of a club of 8.
Subscription to foreign countries, $4 a year.
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Matter for the **Editorial** Department should be addressed to
The Editor of The Electrical World, New York.
Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed to
W. J. JOHNSTON, Publisher,
Potter Building, New York.
OR ANY OF THE BRANCH OFFICES.

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In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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Vol. VIII. NEW YORK, SEPT. 4, 1886. No. 10.

THE discussion of the speaking powers of the Reis telephone is one that has been a prominent one in nearly all of the many telephone suits tried thus far, and the question is one that will probably give rise to more controversy in the future. Prof. Nipher, in another column, gives an interesting account of a simple manner of insuring efficient action in the original Reis instrument. He adds a tension regulator to the diaphragm so that the electrodes are prevented from separating by the vibrations of the diaphragm. To those interested in telephonic history, Prof. A. E. Dolbear's *resumé* of early telephonic literature, given on another page, will also give a good idea of what can be done in hunting up antecedents for the telephone.

THE reply of J. Harris Rogers to the cross-bill of Attorney-General Garland is a general denial of all the allegations set forth in that document, and repeats some of the statements characterized in Garland's reply as scandalous. He seeks to shield himself from the accusation of having caused the publication of false and malicious statements by the assertion that he must have been imposed upon by some malicious person.

A CORRESPONDENT in another column throws some light on the status of the interference in the Patent Office between Edison and Berliner, regarding the carbon transmitter. He attempts to show that even if the patent should be awarded to Edison, the life of the patent would be limited to the date of expiration of the foreign patents taken out some time ago. On the other hand, he seems to fear the outcome in case Berliner should be successful, for in that case the patent would be operative for the full term of seventeen years from the date of issue.

FIFTY years ago Charleston and most of the South might have been swallowed up without those at the North knowing anything about the catastrophe for several days. On Wednesday of this week, however, when it was announced that there had been no telegraphic communication with Charleston since before the earthquake, and fears were entertained of the safety of the city, the excitement was intense all over the country, until messages giving definite information arrived. The incident illustrates once more how indispensable the telegraph has become in this day and generation.

THOSE unacquainted with the history and progress of the telephone frequently observe phenomena which to them appear as new, as is evidenced by the communication of a correspondent who has recently noted the speaking qualities of the call-bell magnets in his telephone instrument. The phenomenon has probably been noticed by others, and its manifestation is probably dependent upon the resonant qualities of the inclosing-box. The result is due to the "Page effect," which has been applied in more than one form of telephone receiver, and to good advantage.

EARTHQUAKE shocks of marked severity are so rare in this section of the globe that the recent occurrence of such a one attracts more than ordinary attention. It seems more than probable some connection exists between the shock experienced here and those of recent occurrence in other portions of the earth. The idea suggested by Major Powell of comparing the movement with the line of least resistance o the earth's surface on this continent will doubtless attract the attention of scientific men. Taken in connection with the recent terrible catastrophe in New Zealand and the still later and also disastrous earthquake shocks in Greece and Italy, there is much in the present phenomenon to interest seismologists.

WE illustrate this week additional designs of Mr. Chandler for the operation of his system of suspended wire transportation. This inexpensive method of building transportation lines was first put in practical operation in this country on an experimental scale at the Philadelphia "Novelties" Exhibition last year. Since then, experiments on a larger scale have been made with the system at the works of the Daft Company, where the working of the short road erected is said to be very satisfactory. Mr. Chandler's suggestion, to employ the system in connection with the life-saving service along our coast, is not a bad one, as rapid communication and means for transportation are highly desirable in case of accidents to ships at a distance from a life-saving station.

AFTER nearly a year of deliberation and delayed action the labors of the Subway Commission of this city have borne fruit, and work on the conduits has now been begun. That wires can be successfully operated underground is no longer open to doubt, and we believe that if well constructed the proposed conduit will answer the requirements of durability. From our report in another column it will be seen that under the circumstances existing on the street first opened, it has become necessary to lay the conduit lower than was contemplated in the original plans. This is due to the nearness to the surface of the gas pipes, and hence, in order to obtain a true alignment the step taken became imperative. Where these conditions do not prevail, however, the original plans will be adhered to.

OUR special correspondent's report of the first day's proceedings at the Electric Light Convention is published in this issue, and will be found exceedingly interesting reading. The Association is gaining both in numbers and influence at each successive meeting and its deliberations are undoubtedly having effect upon the electric lighting industry of the country. The number and contents of the papers submitted give evidence of fact that every point of importance will be brought up for discussion. The members of the association at Detroit are having an excellent opportunity of judging for themselves upon the question of the tower-lighting of cities, and every facility is being offered them for thorough investigation. It is to be regretted that the Association is deprived of the presence of President Morrison at this meeting, the more so considering the cause of his enforced absence.

A NOTE in another column, giving the results of experiments, in which it was demonstrated that chemical action was intensified when the substances were placed in a magnetic field, shows that electro-chemistry presents a vast field for research. The particular phenomenon above cited has been observed some time ago, and Prof. Ira Remsen, of Johns Hopkins University, has devoted particular attention to its study, but his results have not yet been made public. In the meantime, however, electro-chemistry is occupying more and more the attention of chemists. Roscoe and Schorlemmer, in their standard work, have begun to classify and discuss the reactions of the elements according to their position in the scale of electric potentials, and the step they have taken has proven a great help to the elucidation of the laws of chemical combination. Electro-chemical analysis, though employed to some extent even now, is destined to be of greater importance, so that the chemist of the future will also, of necessity, have to possess a knowlege of electricity. This case is the parallel of the one cited recently, in which Colonel Flad, the President of the Society of Civil Engineers, remarked in a recent address that the engineer of the future will have to be as conversant with electricity as with hydraulics.

AS WE have frequently had occasion to remark, there is hardly a phenomenon in the wide domain of electricity which cannot be called into play in the construction of a telephone receiver. From the "knitting needle" of Reis, acting on the principle of the "Page effect," we need only call attention to the magneto or ordinary form, the thermal telephone, the speaking condenser and numerous others. Indeed, it would almost appear that new forms could scarcely be conceived, when we are brought face to face with a combination of two well-known forms which constitutes a decided novelty. We refer to the receiver of Dr. Orazio Lugo, which is described in another column, and which is a combination of the ordinary magneto telephone with the speaking condenser. This form, however, as Dr. Lugo points out, makes it specially adapted as a long-distance receiver, since the condenser has two functions. It assists not only in the reproduction of speech direct, but its reaction upon the magneto coil is such as to increase the power of the latter. The use of the condenser here is quite analogous to that in telegraphy. In duplex and quadruplex telegraphy over short lines the static charge of the line is so small and rapid that no bad effect is produced in the line instruments. But on long liues the discharge is so great that it affects the relay and causes a false signal. To remedy this evil the condenser is connected in circuit so as to discharge itself around the relay coil in the opposite direction of the line discharge, and hence neutralizing it. The same principle, it will be noted, has been applied in the new form of telephone, which seems well adapted for its intended purpose.

THE wire gauge question, which has been the subject of discussion at the Electric Light Convention this week, and will be also at the Telephone Convention the week following, is still unsettled. It is true that the National Telephone Exchange Association has indorsed the new British standard gauge, after mature deliberation, but it seems that other organizations are unwilling to commit themselves to it without further investigation. Thus, both the American Institute of Electrical Engineers, as well as the National Electric Light Association, have appointed committees to investigate and report upon the question of a standard gauge. Regarding the use of the new British gauge on the continent of Europe there appears to be considerable misunderstanding. While some claim that it is in extensive use in Germany and France, the reverse is asserted to be the case by others. In another column Mr. Welles, Superintendent of the Bell Telephone Manufacturing Company's factory at Antwerp, Belgium, insists that the new gauge is far from being in general use there, and that the old method of counting by millimetres and hundredths of millimetres will probably continue to be used. Mr. Welles cites the testimony of large wire manufacturers to substantiate his assertions. The strongest argument generally brought in favor of the new gauge is its extended adoption abroad, but if it shall appear that such is not the case, we think that one of the best alleged attributes of the gauge is lost. From the tenor of the replies received in answer to our inquiries among manufacturers and users of wire, published a short time ago, it appeared that while nearly all seemed to be in favor of a uniform gauge, a large percentage appeared to look upon the general adoption of the standard British gauge as unlikely in this country. Indeed, a deliberate survey of the question seems to point to the fact that users of wire are gradually drifting to the designation of wires in thousandths of inches.

Meeting of the National Electric Light Association.

[FROM OUR SPECIAL CORRESPONDENT.]

DETROIT, Aug. 31.

The convention has just settled down to work in a quiet and business-like way, with little to record in a brief telegraphic dispatch as regards the preliminaries. The list of names I forward herewith will give an idea of the size of the gathering up to the present time, with the reinforcement of all in Detroit in any way connected with electrical interests. Up to this evening there were altogether about 100 in attendance, while the influx of visitors to the hotel to inspect the electrical novelties was very large.

The names of those present are as follows :

Akron, O.—G. G. Baker.
Baltimore, Md.—Arthur Steuart, T. C. McCoubray, Jr., C. R. Sharretts, P. O. Keilholtz, W. Baxter, Jr., W. B. Krout.
Binghamton, N. Y.—John Anderson.
Boston, Mass.—A. V. Garratt, H. McL. Harding, F. Ridlon, E. D. Libbey, A. F. Upton.
Bridgeport, Conn.—Col. F. A. Mason, H. D. Stanley.
Chardon, O.—L. E. Parsons.
Chicago, Ill.—C. H. Cone, W. J. Buckley, H. Ward Leonard, H. A. Glasier, Frank Stewart, C. C. Haskins, J. H. Shay, W. A. Kreidler.
Cleveland, O.—J. B. Crouse, F. E. Pettingill, G. W. Stockly, Wm. F. Swift, W. H. Lawrence, A. Pfannkuche, W. H. Boulton, W. B. Cleveland.
Fort Wayne, Ind.—P. A. Randall.
Indianapolis, Ind.—Brainard Rorison, A. S. Hickley.
Kansas City, Mo.—E. R. Weeks.
McKeesport, Pa.—Z. Latshaw.
New Haven, Conn.—S. J. Fox, F. A. Gilbert, J. English.
New York—Clark B. Hotchkiss, W. M. Callender, H. M. Smith, J. L. Barclay, Frank Harrington, Henry Hine, R. W. Pope, Geo. L. Beetle, Geo. Manson, C. W. Price, R. W. Ryan, T. C. Martin, C. E. Stump.
Norfolk, Va.—W. W. Chamberlain.
Olneyville, R. I.—R. T. Robinson.
Philadelphia—P. B. Richards, J. C. Pentz, Stephen Holbrook, N. H. Edgerton, George W. Boyer, A. J. De Camp, George F. Porter, W. E. Sharpe.
Pittsburgh, Pa.—S. A. Duncan, J. E. Ridall.
Providence, R. I.—C. A. Wilkinson.
St. Joseph, Mo.—Jos. A. Corby.
St. Louis, Mo.—D. R. Russell, J. A. J. Shultz, G. W. Parker.
San Francisco, Cal.—Geo. H. Roe.
Troy, N. Y.—F. A. Cheney, N. McCarty.
Woburn, Mass.—F. Swift, M. M. M. Slattery, W. R. Kimball.
Youngstown, O.—A. B. Cornell, J. H. Clarke.

It will be noticed at once that the name of President Morrison is absent from the roll. Mr. Morrison, accompanied by his wife, left Baltimore for Detroit last week, with the delegation from his city, but on the journey Mrs Morrison was overcome by the heat and fatigue, and was so seriously ill that Mr. Morrison had to turn back, leaving the other members of his party to go on. I need hardly say that the absence of the President is felt very keenly by all, especially under the circumstances that keep him away. Mr. De Camp, Chairman of the Executive Committee, was early on the spot, accompanied by his wife, and Vice-President Weeks came in bright and smiling on Monday, as fresh as though Kansas City were as near Detroit as Windsor is. Some of the delegates arrived Sunday, most on Monday, and nearly all badly "broken up" by the heat and fatigue of the journey, not to say by the royal "good time" enjoyed en route. At the present time the weather is pleasant and cool, and there is every indication that the Detroit meeting will be enjoyable and memorable.

One drawback in connection with the meeting here is the lack of accommodation. The headquarters of the association are at the Russell House, a good hotel, but one not calculated to meet the exigencies of a large influx of guests added to its regular patronage. The result is that some of the delegates have had to get rooms elsewhere, and others are "doubled up;" while parlors for exhibition purposes are very scarce. There is no room in the house large enough for the meeting, but it has been arranged to hold the sessions in the Council chamber immediately opposite, across Woodward avenue. Under such conditions, it can easily be understood that there has been great difficulty in keeping everybody in a contented frame of mind on the score of accommodation, but Secretary McCoubray, though deprived of the advice and assistance of President Morrison, has worked splendidly to put matters in good shape, and he has the satisfaction of knowing that his efforts have been crowned with success.

The hotel offers a very lively appearance, and its atmosphere is naturally surcharged with electricity. Morrison's Electrical Works make a brave showing with the Baxter motor, the new am-meter and voltmeter, switchboard plugs and other articles; Washburn & Moen have a good exhibit of their wire; Mr. Swift and Mr. Slattery, of the Sun Company, of Woburn, Mass., have a fine display with their new distributing box and new lamps; Mr. W. B. Cleveland has his now well-known cut-outs on exhibition, and Mr. Clark B. Hotchkiss has samples of his kerite wires and cables. The Edgerton Motor Company and the Parker Russell-Mining and Manufacturing Company also have exhibits. Dr. Garratt is lighting part of the bar-room with Volta-Pavia cells. Mr. A. S. Hickley, of the Indianapolis Jenney Company, has some 300 and 400 c. p. incandescents running on an arc circuit. Mr. Barclay, of Holmes, Booth & Haydens, and Mr. Pfannkuche, of the Forest City Carbon Co., are running cored carbons in Thomson-Houston arc lamps, giving a beautifully steady light, with no travel of arc at all. Altogether, the Russell House would pass muster as a very fair headquarters for electrical supplies and novelties.

Not the least of the reasons for the visit of the Association to Detroit was the desire of many of the members to see a good tower system. Detroit is certainly a fine example of what can be accomplished with towers. The local Brush Company has, according to the statement made by Mr. W. W. Leggett, the president of the company, at the meeting to-day, and reported further on, 122 towers in use, lighting 21 square miles with 576 arc lamps. As far as I can judge from inspection, the results are admirable. On Monday night I drove around the city with Mr. Leggett, and had opportunities of judging of the effect under the most varying conditions of tree shade, style of building, density of population, and contour of the city and of the residential districts. The towers are nearly all 150 feet in height, though one or two are higher. The effect throughout is that of a soft, pervasive moonlight. Here and there a road looks dark, but when you drive up it, the shadows flee away. A strange feature is that when the front of a man's house is at all sombre, it is because the back yard or the surrounding garden is thoroughly illuminated; and thus the shade in front is rather that of contrast than of actuality. No other system I know of will light up the back as well as the front of a street. This does it well, and gives a double security to householders against burglarious attack. I have taken the trouble to ask several people here, who have no interest in the matter, how they like the towers, and the answer has invariably been favorable. In fact, there is even a strong local sentiment of pride in the matter, and one that it is really pleasing to find. After making the tour around town, we visited the station, now running about 900 lights, and so overloaded that a new station of 2,000 lights is soon to be built. Altogether, with its two arc stations and its incandescent station, Detroit is pretty well supplied with electric lights. Probably there is no other city of its size—about 200,000 inhabitants—with so much capital invested in the business.

The programme of business laid out to-day by the Executive Committee is as follows :

1. Revenue. Dr. Otto A. Moses, New York.
2. Tabulating Rates of Public Lighting. H. W. Pope, Elizabeth, N. J.
3. Standard Wire Gauge. R. W. Pope, New York.
4. Protest against the Enforcement of Electrical Subways. E. R. Weeks, Kansas City.
5. Some Features of Incandescent Lighting and Wiring. T. C. Martin, New York.
6. Wire Joints. C. C. Haskins, Chicago.
7. Platinum. J. O. Baker, Newark, N. J.
8. Carbons for Incandescent Lighting. A. S. Hickley, Indianapolis, Ind.
9. Accumulators. Dr. G. H. Benjamin, New York.
10. Adaptation of Carbon Points to Different Currents in Arc Lighting. G. W. Parker, St. Louis, Mo.
11. Operation of Motors from Electric Light and Power Stations. T. C. Martin, New York.
12. Transmission of Power from Steam Motor to Dynamo. James A. Pentz, Philadelphia.
13. Legal Relation of Electric Light Companies to Telegraph and Telephone Companies and to the Patent-Office. Arthur Steuart, Baltimore, Md.

During this morning a large number of delegates arrived, and Mr. W. F. Swift, Secretary of the Brush Electric Co., took a large party out driving through the city in carriages. On their return, the association met in the council chamber at twelve o'clock.

In the absence of President Morrison, Vice-President Weeks presided.

The address of welcome was made by Mr. W. W. Leggett, on behalf of the local Brush Company, who invited the delegates to go driving around the city on Tuesday night to see the tower system in operation, and who have chartered the "City of Cleveland" for a water trip on Thursday evening, so that the delegates may be able to see the towers from that point of view. The lights are visible 28 miles away.

Letters of acceptance as honorary members were read from Dr. Werner Siemens and Mr. J. T. Sprague. The Executive Committee reported the order of business, after which the Secretary read his report, showing that the association has now 125 members, which is 13 new members since the last meeting at Baltimore in February.

A paper was read from Dr. Otto A. Moses, presenting a plan for a bureau of information. The matter was referred to the Executive Committee.

The Committee on Tabulating Rates reported progress. Mr. Ralph W. Pope presented a report on the Standard Wire Gauge. He said that no steps toward standardization have been taken by manufacturers, and added that the general tendency on the part of both producers and consumers who desire accuracy in filling orders is to furnish a sample or specify the diameter in thousandths of an inch, with further stipulations in some cases as to the weight and resistance. He read a letter from Mr. F. R. Welles. The subject was discussed, after which an adjournment was taken.

Mr. Weeks read a vigorous protest against the enforcement of electrical sub-ways. This elicited active discussion and was indorsed by the association, which evidently dislikes any crowding of this matter. Mr. De Camp said that whenever wires did go under ground anywhere it must be by an inclusive system for all classes of wires. Mr. Martin, of THE ELECTRICAL WORLD, read a paper on Incandescent Lighting. The discussion on the paper was reserved until Wednesday. Mr. Leggett made an interesting statement as to the tower system in Detroit. He said that they had 122 towers, lighting 21 square miles, with an aggregate of 576 arc lights. There is one circuit twenty miles long, with fifteen towers on it. The price paid by the city annually is one hundred and fourteen thousand five hundred dollars, and the people are highly pleased with the light. The meeting then adjourned for the day.

During the evening a large party went out to see the towers, driving all over the city, not only in the business, but also in the residential and suburban portions, and on their return expressed themselves generally as highly pleased. The station was also visited and inspected.

In order to supply needed information to the delegates, we have issued THE ELECTRICAL WORLD'S Bulletin of the Association, with names of officers, list of members and visitors, and programme. This convenience is highly appreciated and greatly in demand among all present. It will be kept up until the close of the meeting, and will contain each day a brief sketch of the previous day's work.

Thunderstorms.

From certain meteorological statistics recently published in Germany we learn that thunderstorms in that country have during the last thirty years been steadily increasing, both in frequency and severity. The number of deaths per annum from lightning has increased in a far greater ratio than that of the increase of population. In the present state of our knowledge of the whole subject of atmospheric electricity, the cause of the phenomena of thunderstorms is confessedly obscure. It is, however, very possible that some light would be thrown upon the question by a comparative study of the frequency and severity of storms during a lengthened period and over a wide geographical area. The German *savants* incline to the opinion that the increase is to be attributed to the enormously increased production of smoke and steam which has taken place during the last three decades. But although we may admit this to be to some extent a probable *vera causa*, yet when we consider the very local character of thunderstorms, we should naturally expect to find that it would follow that the neighborhoods of large cities, and especially of manufacturing districts, would suffer the most severely. But the statistics referred to show distinctly that the very reverse is the case. The number of storms attended by fatal results from lightning is far larger in the agricultural districts than in the towns. Upon the other hand, we ought to take into consideration the protective action of lightning conductors with which the prominent buildings in the towns of Germany are well provided.

Measuring Galvanic Currents in Electropathy.

Professor Erb was the first to point out the necessity for using a galvanometer in electropathy, as an indication of the number of cells is not only insufficient, but also frequently incorrect. Bichromate batteries are also very uncertain in their action, on account of the continual variation of their electromotive force, which depends not only on the greater or less depth of immersion of the electrodes, but also on the rapid alteration of the surface of the zinc and the chemical composition of the exciting liquid. Horizontal galvanometers possess great advantages over vertical, as the latter are constantly subject to the action of terrestrial magnetism, and even when correctly set at the commencement of an operation, they soon give incorrect readings; their sensitiveness also depends on the position of the centre of gravity of the needle and its magnetization, which latter is subject, under the action of the current, to constant variation.

The correctness and constancy of horizontal galvanometers are independent of the magnetization of the needle, which always returns to zero in the direction of the magnetic meridian, whatever be the force of magnetization. When the spot is determined where the instrument is to be used, it is easy for the constructor to adjust the galvanometer to the horizontal intensity of the terrestrial magnetism of the locality in question. In order to give horizontal galvanometers the advantages of a vertical reading, which is more convenient than the horizontal for medical use, Dr. Edelmann suggests bending downward the end of the horizontal needle, and placing a vertical scale on the curved surface of the galvanometer case, thus combining the good qualities of both systems.

Couldn't Let Go.

The telephone company have an electric generator run by the machinery at Clark & Courts, which is used by the exchange for ringing up subscribers. The current from this generator is exceedingly energetic, and one with which it is extremely disagreeable to come in contact. The wire conveying it to the central office runs over roofs to Mechanic street, thence on top of the company's poles to the exchange. One morning a short time ago this line was found to be out of order, and a lineman started out to find the trouble. He found that some workmen engaged in making repairs on one of the roofs had broken the line. As he had stopped the motion of the machine before

ascending to the roof, he immediately laid hold of the wire and proceeded to repair it. His motions were watched with a great deal of interest by one of the workmen, who cautiously approached and inquired: "What kind of a blamed wire is that?"

"This? This is a telephone wire," replied the repairer.

"Not one of them wires you talk through?" queried the workman, in some astonishment.

"Yas, sir," grinned the lineman, who thought he understood the reason of these questions, "that's what it is."

"Wall, now, could you tell me who was a talkin' through that wire about an hour ago? It must 'a been some of the hottest talkin' that ever anybody done, 'cause I happened to put my hand on it an' it jest wiped me all around this housetop; if the blamed thing hadn't broke I reckon it would have taken three or four able-bodied men to help me let go. If you ever hear whose cussin' I got I wish you'd let me know, so I can restore it to its rightful owner."—Galveston *Evening Tribune.*

A Violent Earthquake.

Shortly before 10 o'clock on the evening of Aug. 31 the country from Maine to Florida was visited by earthquake shocks which, though severe and well defined, were accompanied by serious loss of life and property in only one instance, that of Charlestown, S. C. In this city, the wave motion seemed to be in a line from east-southeast to west-northwest.

There were two series of vibrations, the first lasting about twenty seconds. There was an interval of four or five seconds, and again a series of stronger oscillations, covering perhaps thirty-five or forty seconds.

In the Western Union Telegraph Building the shocks were not noticed on the lower floors, but nearer the roof they created quite some excitement. In the operating room on the seventh floor the vibrations brought the clicking of the instruments to a standstill until the tremors ceased. Several of the operators jumped from their seats supposing that the west wall was falling out. The swaying of a switchboard while the vibrations lasted seemed to convince the more nervous of the telegraphers that the building was giving way. Before the operators could leave their desks, however, the shivering ceased, and then they felt assured that it had been caused by an earthquake.

In the rooms of the Associated Press, on the top story, during the minute or less that the shocks lasted, desks, tables and chairs seemed to be swaying. The motion was described by all as from west to east and back again. It was a "gentle, wavy sort of a shake," as an operator said, and still one that made persons so high up and so far away from the street wish for the moment that they were somewhere else. The waves had only stopped rolling when reports began to come in announcing that the earthquake had been felt hundreds of miles away from the city. In the Western Union building the time that the shocks occurred was marked down as eight minutes to ten.

The Perrin Multiple Switch-Board.

When telephone exchanges were first established, single switch-boards having, in most cases, a hundred drops were installed at the central offices in various large cities, and these for a time sufficed to allow of connection between the subscribers by a single operator. As the number of subscribers increased, however, more of these switch-boards were added, until in some cases the number became quite large. With this system, in order to put a subscriber connected to one board in connection with a second on another board it was necessary to have the various boards connected by trunk lines, and when a call for such a connection was made the operator at one board would have to communicate with the one attending the other board, so that two operators were required to make the one connection. This inter-communication, of course, occupied time and was in other ways inconvenient, so that it soon became manifest that for quick and accurate work a switch-board must be designed so that an operator would be able to connect any two of the subscribers together whether their lines were connected to the annunciator drops on her board or not.

This demand gave birth to what is known as the "multiple" switch-board, in the construction of which many new problems had to be solved.

The principal requirement of such a board is evidently that no interference shall take place between the operators acting independently; so that, for instance, one operator does not connect up to a subscriber who has already been put in circuit on another board. Again, the arrangement should be such as to afford compactness and simplicity, so that the operator can make connections and test her lines in the shortest time.

The most recent development in multiple switch-boards having these objects in view is that designed by Mr. T. J. Perrin, of Brooklyn, N. Y., some of whose work in the telephonic field has already been noticed by us, his telephone repeater having been described in our issue of Sept. 19, 1885.

In the new switch-board, three sections of which are shown in perspective in the engraving, Fig. 1, each section is provided with 100 annunciator drops and with the usual number of clearing out annunciators, which are situated at the top of the board.

The frame of the board *A* is bored for each terminal, and the line terminal devices are fitted therein, as shown in Fig. 4. The latter, as shown in section and side views in Figs. 5 and 6, are inserted in the aperture from the rear of the board, and consist of a plug of insulating material *a*. This plug carries two metallic spindle sections *b c*, which are insulated from each other, and against which bear two contact springs *f g*, which project forward through the aperture in the board. Each spring and each spindle section are independently connected with a binding screw on the rear face of the plug, as shown in Fig. 7, Fig. 9 showing a plan view of each plug. Each opening in the board is, in addition, faced with a metallic ring *e*, Fig. 4, and shown in detail in Fig. 8. The object of this ring will appear later on.

The arrangement of the lines is very simple, and is clearly shown in the diagram, Fig. 2, which represents the three sections of the switch-board. As will be seen, all the main lines are brought in at section 1 of the board, and after running to their terminals of like number on the several sections, pass to their annunciators *I I*, at their particular boards, and from thence to earth.

Following out the course of line 1 of section 1, we see that it runs to the binding-screw *h*, at the bottom of the plug described above, which screw is connected with the upper spring finger *f*. The latter, in turn, bears against the spindle section *b*, which is connected with the binding screw *i*. Thence the line continues to section 2, following out the same course and passing to section 3, which we may here, for the sake of illustration, consider the last section of the board. On the last board the line, after passing as usual to the screw *i*, is connected around the plug to the screw *j*. This screw is connected to the lower spring finger *g*, which bears against the lower spindle section *c*, and is, in turn, connected to the binding screw *k*. The line then passes back again to the corresponding plug of each section, passing through the lower spring fingers and spindle sections, as is clearly shown; being finally connected to its proper annunciator, and then grounded.

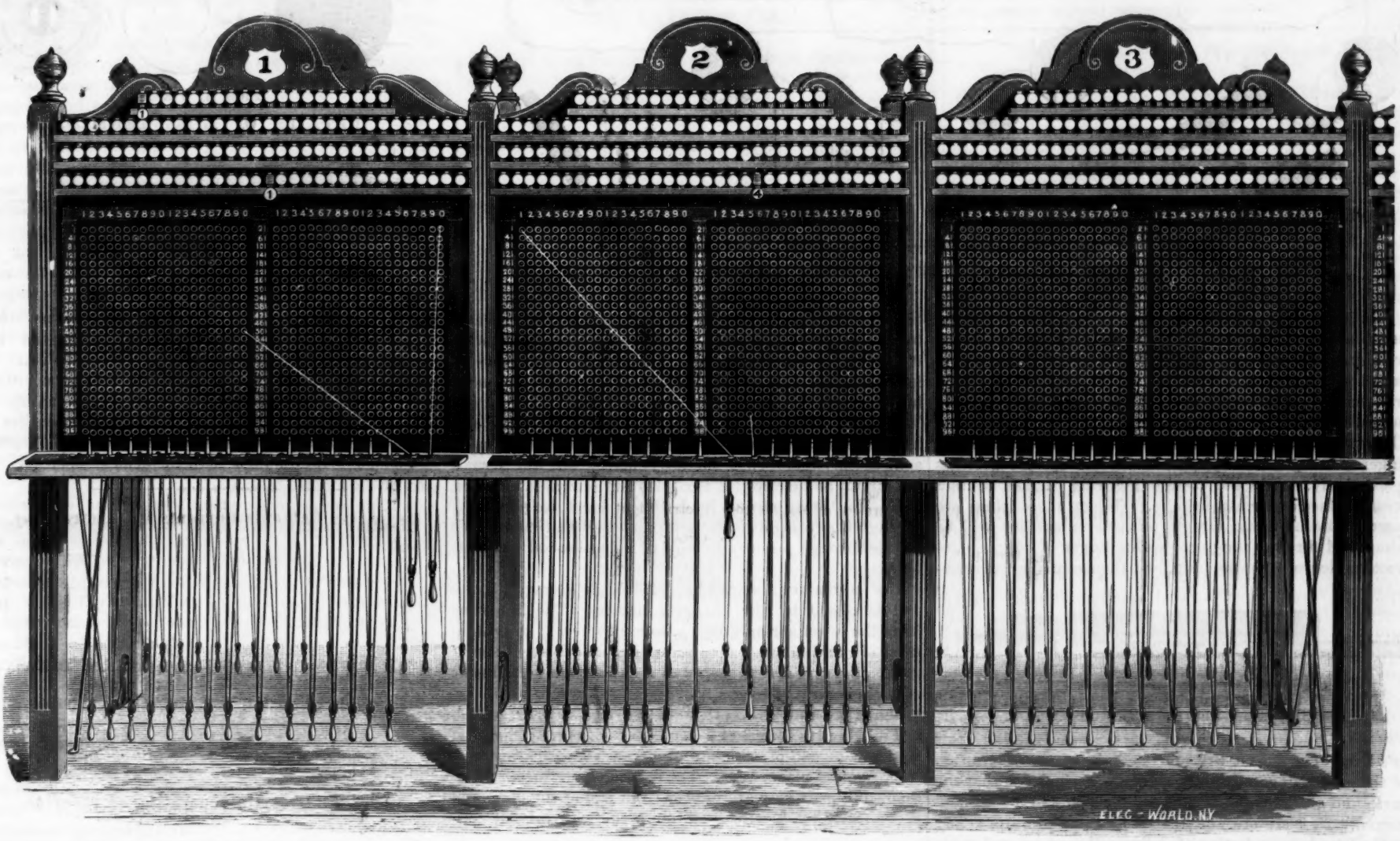


FIG. 1.—THE PERRIN MULTIPLE SWITCHBOARD FOR ONE THOUSAND SUBSCRIBERS.

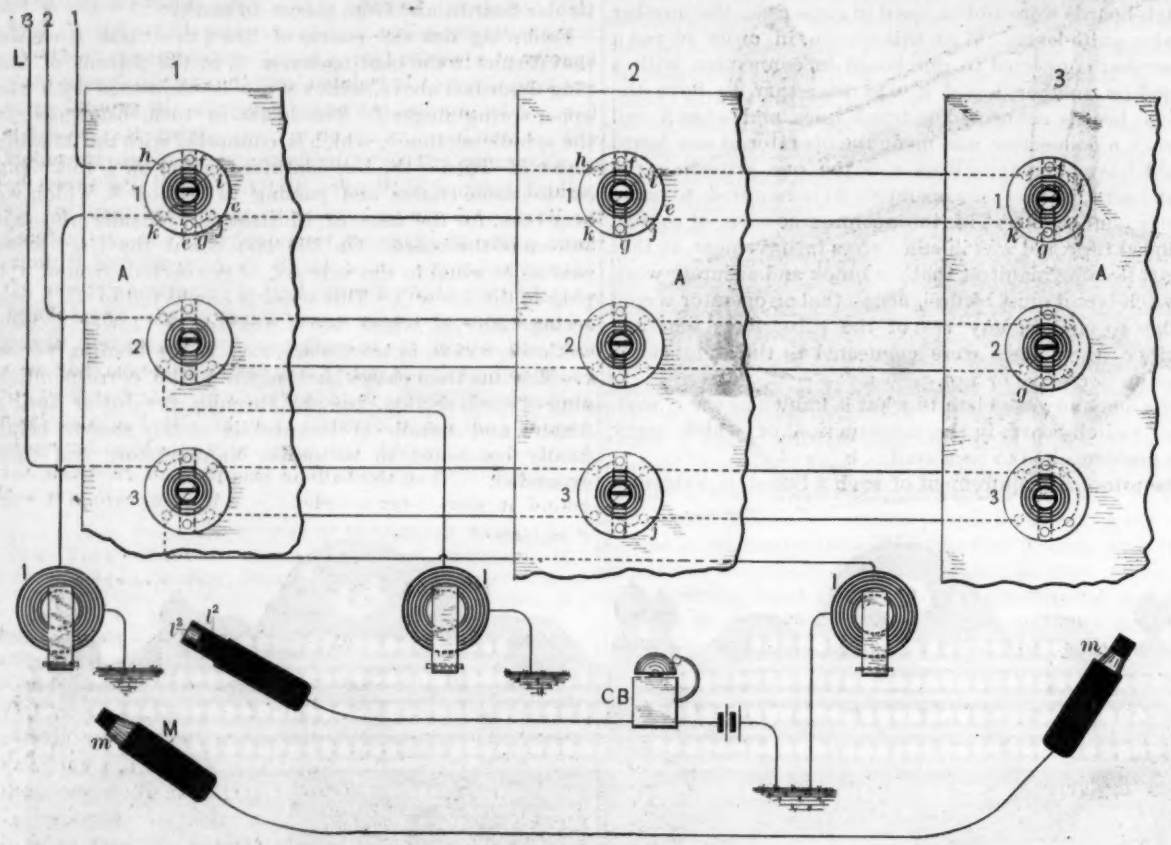
As before stated, in order to avoid confusion and interference it becomes necessary for every operator, before making a connection, to ascertain if the line is in use, and for this purpose a test plug is provided, which is connected up as shown in the lower portion of Fig. 2, and seen in section in Fig. 11. This plug is composed of a handle of insulating material, in the front end of which is secured a brass sleeve *l*. The interior of the sleeve is lined with insulating material l^1, and the exterior is also covered with insulating material l^2, except at the point l^3, where the insulating material is cut away so as to leave the brass sleeve exposed. On the side of the plug, opposite the exposed portion of the sleeve, a section of the insulating material is cut out so as to form an opening in the side of the plug, as shown at l^3, Fig. 11. The metal sleeve is connected through a call bell and battery to earth, as shown in Fig. 2.

Now if the operator at any one of the switch-boards wishes to ascertain whether any one of the lines is in use, she inserts the test plug just described in the terminal of that line. When this is done, the upper spring *f* will remain undisturbed, because of the test plug being cut away, as described; but the lower spring *g* will be forced out of contact with the lower spindle section *c*, and will bear upon the exposed portion l^2 of the conducting sleeve. If a line is not in use, the operator's bell will sound, and the subscriber's will also be rung, thus calling him. For instance, assuming that the test plug has been inserted in the terminal of line No. 1 on section No. 2, the circuit of the main line No. 1 will run through the upper connections *h*, *f*, *i* of its terminal on section No. 1 as usual, and thence to its terminal on section No. 2. With the test plug inserted

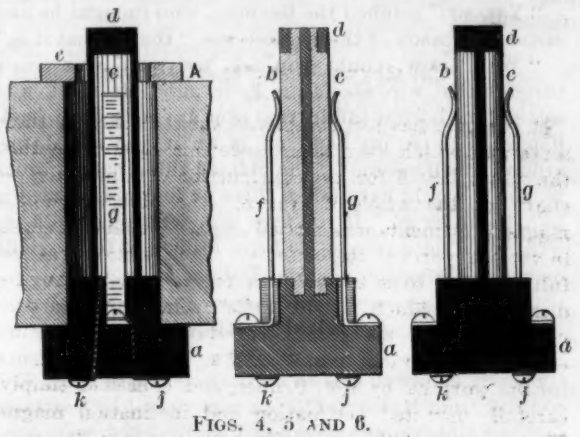
here, however, the circuit runs from the lower spring finger *g* through the metallic sleeve of the plug to the call bell *C B* and battery to earth. This gives a ground at the subscriber's and at the central office, and rings the bells at both places. There will be no circuit to the annunciator of the line, because the insulating material l^1 on the interior of the sleeve breaks connection between the lower spring finger *g* and the lower spindle section *c*.

The diagram Fig. 12, shows a terminal of a line on three different sections of the switch-board, in connection with the subscriber's instrument.

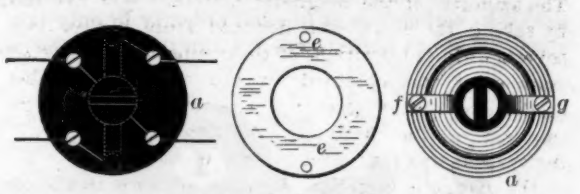
In this arrangement the signaling circuit is grounded as usual, but the talking circuit is metallic. Referring to the former, it will be seen that, when in its normal condition, the line runs from the magneto *D* at the subscriber's to the bell *E*, contact *a'*, switch lever *F* (which is normally held



FIGS. 2 AND 3.—LINE TERMINAL CONNECTIONS AND SWITCH PLUGS.



FIGS. 4, 5 AND 6.



FIGS. 7, 8 AND 9.

DETAILS OF LINE TERMINALS.

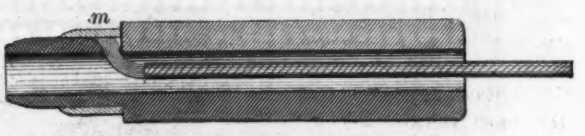


FIG. 10.—SWITCH PLUG.

Having ascertained that the subscriber's line is not in use, the operator proceeds to make the desired connection with each of the connected plugs *M*, Fig. 3. These plugs, one of which is shown in section in Fig. 10, are provided with annular conducting rings *m* surrounding a tube of insulating material which passes over the spindle sections. The end of the tube of insulating material separates the fingers *f* and *g* from the upper and lower spindle sections respectively, while the conducting ring makes contact with the face or terminal ring *e*. When these plugs are inserted the main line circuit of each subscriber will be completed through the upper spring finger *f*, ring *e*, conducting sleeve *m* on the plug, and thence to the subscrib-

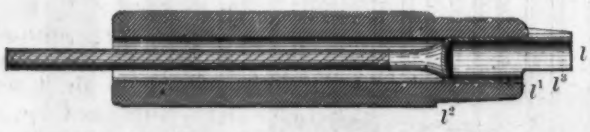


FIG. 11.—TEST PLUG FOR SINGLE CIRCUIT.

er's line. The circuit will now be open by the separation of the spring fingers from the spindle sections, so that the earth and annunciator of each subscriber will be disconnected. If, therefore, the line is in use, an operator at any of the boards upon testing that line will get no signal on his call bell. For instance, let us suppose that line No. 1 is in use and has been connected on its particular section No. 1, and that the operator in No. 3 inserts the test plug at the terminal of that line on section No. 3. The test circuit would then be from the earth to battery and call bell to the conducting sleeve of the plug, spring finger *g*, and screw *j*, through the upper terminals on sections Nos. 2 and 3 to the screw *i* and upper spindle section at the terminal of section No. 1. But here, as we have seen, the circuit is open, because the connecting plug *m* had been thrust between the spindle section and spring finger *f*. There would, therefore, be no circuit for the operator's call bell. As shown before, also, there would be no circuit from the lower spindle section of terminal No. 1 on section No. 3, where the test plug had been inserted, because the insulating lining l^1 would break the circuit from the spring *g* to the lower spindle section, and there would, therefore, be no ground through the annunciator on line No. 1 at section No. 1.

While the arrangement of the board has taken some length to describe minutely, it will nevertheless be acknowledged to be very simple and to embody many excellent features, not the least important of which is the cheapness with which the board can be constructed.

The board as above described is arranged for the single wire circuit and earth return; but foreseeing the time when the complete metallic circuit will come into vogue, Mr. Perrin has contrived a very simple method of changing the arrangement so that the board shall be suitable for metallic circuit. In fact, the only alterations required to accomplish this are the addition of a single line connection to each ring at the terminals of the lines, and a change in the connecting plugs.

down by the weight of the hand phone), up to line and to binding post *k*, at spring-jack *A*; and from that point it follows out the same course through all the sections as in the single-circuit system described above, finally passing through the annunciator *G*, and then to ground. When the subscriber removes his telephone from the hook, the switch lever *F* is drawn up by the spring *s* against the contacts *n*, *l*, thereby cutting out the signaling circuit and closing a local battery circuit at his station. The local circuit runs from local battery *L B* through the transmitter to switch lever *F* and contact *n*; thence through primary battery of induction coil *I* to battery.

The secondary or talking circuit is normally open and is closed by the plugging devices. The line runs from the lower spring finger *g*, to bind-screw *k*, to switch-lever *F*, and contact *l*, to induction coil *I*, telephone *J* and back again, being tapped to the face-plates or rings *c* at the several sections.

The plug employed by the operator is shown in section in Fig. 13. It consists of a handle of insulating material in the front end of which are placed two separate metallic contact pieces *x*, *x'*. The first contact piece *x* extends only part way around the front end of the plug and is connected by a wire *y*, through the clearing-out an-

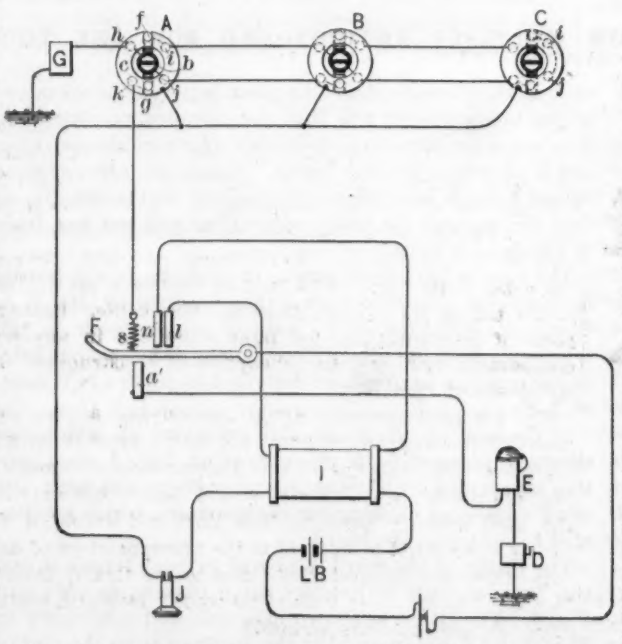


FIG. 12.—BOARD CONNECTIONS FOR METALLIC CIRCUIT.

nunciator, and then to the corresponding contact *x* on the other plug. The contact *x'*, which is insulated from *x*, is a sleeve encircling the plug just back of *x*, and is connected by wire *y'* with the corresponding sleeve on the other plug.

When the plugs are inserted in the spring-jacks of two different lines, the upper spring finger *f* is moved out of contact with the spindle section *b* by the non-conducting end *z* of the plug. The lower spring finger *g* makes contact with *x*, and the sleeve *x'* makes contact with the ring or face plate *e*. The complete secondary or talking circuit is then as follows: From the clearing-out annunciator to contact *x* on one plug, to lower spring finger *g*, to binding post *k*, over line to switch lever *F* and contact *l*, to induction coil *I*, telephone *J*; from there back over line to the ring *c*, then to sleeve *x'* on the other plug, and so through the second subscriber's line and second spring-jack back to the clearing-out annunciator.

It will be observed that that part of the circuit which includes the clearing-out annunciator is the signaling line to and from the sub-station, so that the subscriber can signal for disconnection, having first, as usual, replaced his telephone on the hook so as to break or open the other part of the circuit.

The line in this arrangement is tested and signaled over in the same manner, and by the same plugs as are used in

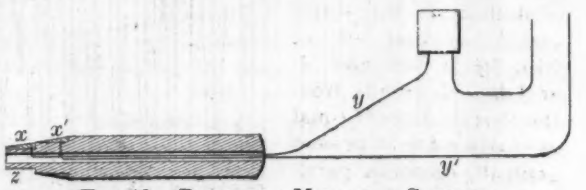


FIG. 13.—PLUG FOR METALLIC CIRCUIT.

the single circuit arrangement, so that no alteration in this respect is required.

The Electrolytic Separation of Fluorine.

The element known as fluorine is chiefly remarkable from the fact that it is the only known element which forms no compound with oxygen. It has an intense affinity for hydrogen, and is extremely difficult to obtain in a separate condition. This difficulty arises in part from the fact that fluorine in the presence of moisture strongly attacks silica; hence it is impossible to treat it in glass or porcelain vessels. The French chemists, Knox and Lonyet, acting upon a suggestion originally due to Sir Humphrey Davy, attempted to prepare this element by treating argentic fluoride with chlorine in a vessel constructed of fluor spar. The experiment did not, however, lead to any very definite results. Since them M. Fremy, by means of the action of dry iodine upon dry silver fluoride obtained a colorless gas which did not attack glass. Recent researches undertaken by M. Moissau have, however, thrown some slight doubt upon the question whether the gas so attained is actually free fluorine. M. Moissau having prepared anydrous hydrofluoric acid (HF) by a method due to M. Fremy, submitted it to electrolysis in a platinum U-tube under the action of 50 Bunsen elements. Hydrogen was given off at the negative pole, and at the positive pole a gas was obtained which had the following characteristics: In the presence of mercury it was rapidly absorbed with the formation of protofluoride of mercury of a clear yellow color. In contact with water the latter was decomposed with the formation of ozone. Phosphorus was inflamed with the formation of two fluorides of phosphorus, sulphur was melted with rapidity, carbon seemed to be unaffected, melted potassic chloride cools with disengagement of chlorine; and, lastly, crystalized silicon takes fire and burns with great brilliancy upon contact with the gas, forming silicic fluoride. The platinum-iridium electrode forming the positive pole

was much corroded, the negative electrode was not attacked. M. Moissau prefers for the present to reserve his opinion as to the exact nature of the gas he has obtained, pointing out that although the most obvious supposition would be that it consists of pure fluorine, yet at present the evidence is not conclusive. It may, for instance, turn out to be a perfluoride of hydrogen, or some mixture of ozone and hydrofluoric acid. It will be noted that the gas differs from that previously taken for fluorine in its action upon silicon.

The Magnetic Survey of France.

M. Mascart has just completed the reduction of the observations which were taken under his supervision during the years 1884–5 for the construction of a new magnetic chart for the whole of France. The observation of the magnetic elements was carried out at 78 different stations in various parts of the country. Each station was carefully selected so as to avoid, as far as possible, any local disturbance which might arise from purely artificial causes, such as the neighborhood of railways, factories, etc. The apparatus employed was specially constructed for the purpose by MM. Bruner, and consisted simply of carefully-mounted declination and inclination magnets. The azimuth of the magnetic meridian was determined by taking the mean value deduced from the readings in several different positions of the compass. The horizontal component was obtained by counting the number of oscillations, after having determined the magnetic moment of the needle by the method of Gauss. The inclination was read directly from the needle when placed in the magnetic meridian. By comparison with the curves of annual and secular variation recorded by the magnetometer at the Observatory of Parc Saint-Maur, all the observations have been reduced so as to be correct for the 1st of January, 1885. The following are some of the most noteworthy results obtained: The declination is a minimum at Belfort (13°·59′) and a maximum at Conquet (19°·25′). In the North of France it varies about 30′ for each degree of longitude; in the south the variation is smaller. Since the last survey by Lamonte, in 1854, the declination has diminished 3°·58′ in the north, and only 3°·19′ in the south. The mean annual variation of declination during this period has been 6·5′ at Nice, 7·4′ at Paris, and 7·7′ at Lille. It results from this that the lines of equal declination are at present gradually becoming parallel with those of the geographical meridians. Turning next to the value of the horizontal component, we find the minimum value (0.18460 absolute units) was observed at Dunkerque, and the maximum (0.22124) at Perpignan. These curves are very nearly perpendicular to those of the magnetic meridian. The decrease of this element per degree of latitude proceeds more rapidly in the south than in the north. Since Lamont's observations in 1848 the mean value

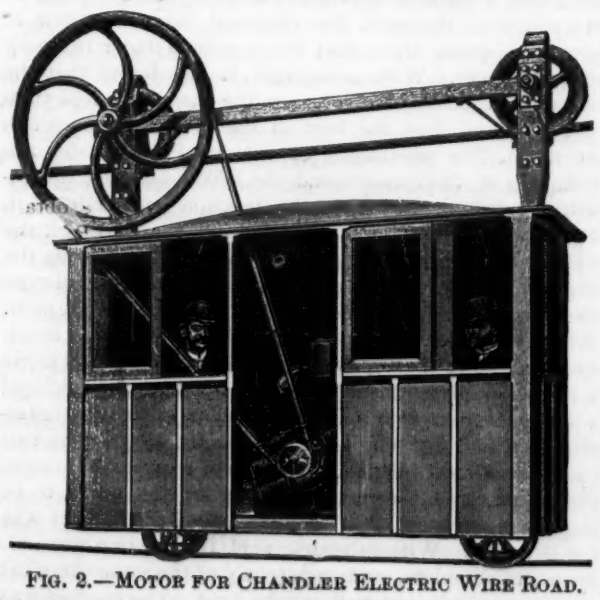


FIG. 2.—MOTOR FOR CHANDLER ELECTRIC WIRE ROAD.

of the horizontal component has increased about 0.05. The annual variation is greatest in the west and slightly less in the east. Its mean value is about + 0.00025. These lines are approaching the direction of the geographical parallels. The isoclinal lines have sensibly the same orientation.

The Chandler Electric Wire Road.

In our issue of June 26th last we illustrated and described the Chandler system of transporting freight and passen-

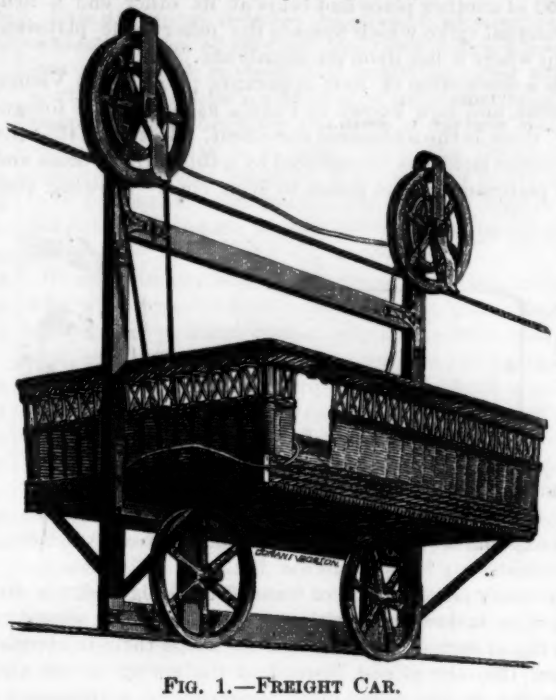


FIG. 1.—FREIGHT CAR.

gers, now being brought to public notice by the Suspension Transportation Company of Boston. The article attracted great attention, and was widely copied in Europe as well as in this country. In view of the interest aroused, we now give some further details of the system. Fig. 1 shows the small "freight express" car operated successfully for several weeks at the Novelties Exhibition in Philadelphia last year. Figs. 2 and 3 illustrate the section of track now in use experimentally at the Daft Works, Greenville, N. J. The illustrations are made from photographs, and show accurately the slight sag in the wire caused by the passage of the car, weighing one ton. The upper cable is two inches in diameter; the lower, one inch. Fig. 3 shows the manner in which the car is enabled to pass the poles on the line. The car seen carries a small Daft motor taking its current from the wire cable. Few systems of transportation for light work are in any way comparable with this for cheapness of construction and simplicity of operation.

Fig. 4 is an illustrative design embodying a plan proposed by the company to adopt for mail service or for life-saving service along the coast. There can be no question that the use of such a device would immensely expedite the mail delivery between New York and Brooklyn, for example, or could be applied in the transportation of mail bags from the General Post-Office to the Grand Central Depot. The saving in time alone would be worth a great many thousand dollars annually.

The life saving idea is not less meritorious in its way. Miles of dangerous coast can be cheaply equipped with such a system, enabling a very small patrol to cover a long stretch of line and yet to reach any point, on call, in a very brief time. The whole line would be one life saving station, to any point of which fullest assistance could be promptly sent.

We have no doubt that in the near future, many of these aerial wire roads will be put in operation in places and regions where the conditions forbid the construction of regular roads with roadbed, track and heavy rolling stock. The initial expense is small, so that these lines can often serve as profitable feeders to large railroads dependent on tap lines for freight from regions difficult of access to any kind of wheeled conveyance.

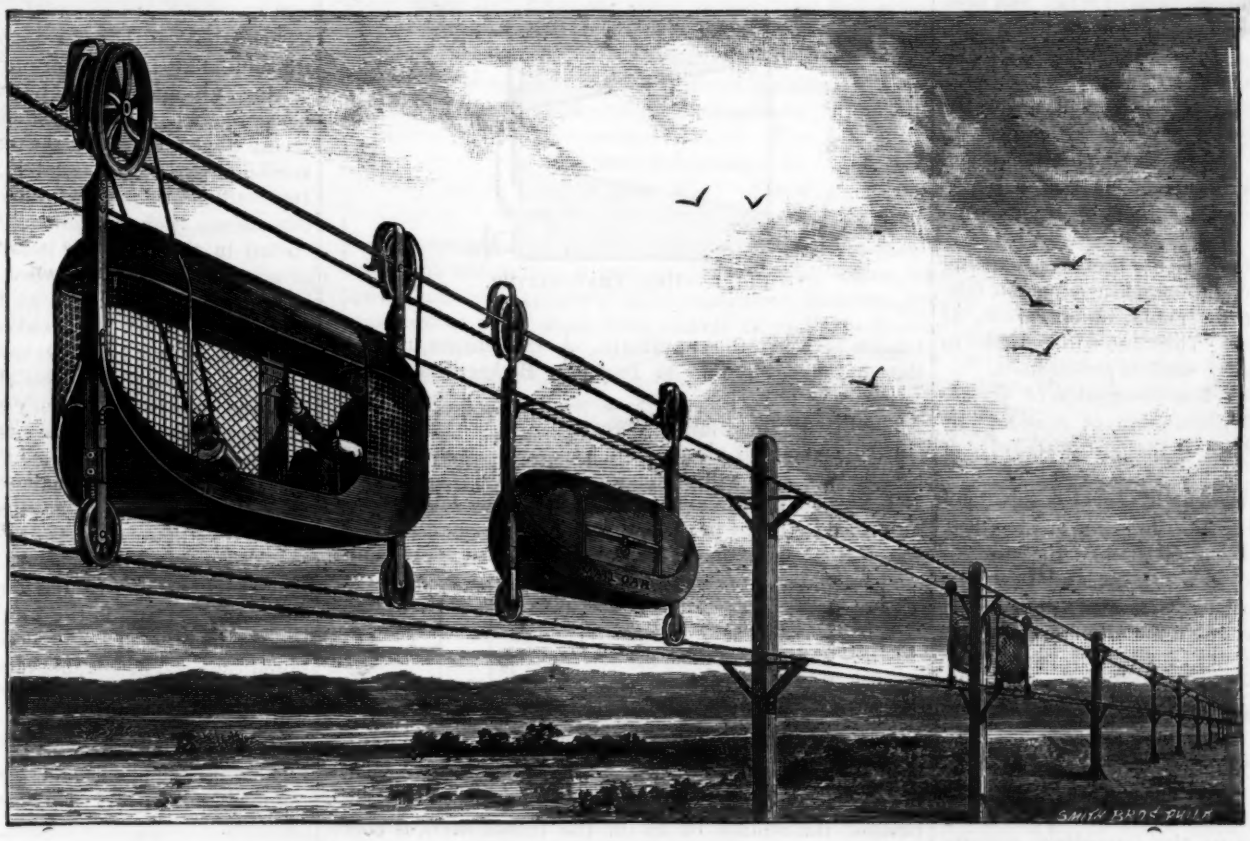


FIG. 4.—PROPOSED DESIGN FOR MAIL AND LIFE-SAVING SERVICE.

Electrical Army Signaling.

Mr. Eric Bruce recently made some additional experiments with his balloon. The latter is of cambric, with a capacity of 4,000 cu. ft. of gas. It contains six incandescent lamps, perfectly isolated from the gas which surrounds them, and connected with the battery on the ground by a cable which helps as a captive rope. When the balloon is at an elevation of 500 ft. the flashes are visible to the naked eye at a distance of 16 miles, and a message delivered by the Morse code can be read by troops stationed at that distance. The experiments were designed to show the feasibility of attaching lamps to the outside of the balloon, whereby they attain a much higher penetrating power. It has been pointed out by some officers of the Royal Engineers, to whom the invention has been submitted, that it would be useful, not only for signaling purposes, but as a preconcerted signal, and as giving a point to march on, or to guide a retreat or advance at night. It has also been shown that it would be of high value as a light for working parties. When the balloon was 15 or 20 ft. from the ground it shed, over a wide area, a light by which it was quite possible to read the smallest type.

Nitrogen Under the Electric Spark.

Recent experiments by Professors J. J. Thomson and Threlfall have brought them to the conclusion that just as ozone is formed by the passage of electric sparks through oxygen, so an allotropic modification of nitrogen is formed by sparking in nitrogen. Very careful experiments have been made by these investigators, and the conclusions they have come to are: (1) That when a succession of electric sparks of the proper kind is sent through a sealed discharge tube containing nitrogen at a low pressure (less than 20 millimetres of mercury), a permanent diminution of the volume of the nitrogen takes place and reaches a maximum, after which the passage of 1 cm. in diameter, for example, and induction coil sparks 4 in. long in air, it took eight hours' sparking to produce the maximum diminution. (4) The diminution took place equally well with platinum and aluminium electrodes. (5) The ratio of the maximum diminution to the original volume is independent of the volume of the discharge tube and of the extent of its surface. (6) If the tube be maintained at a temperature of over 100° C. for several hours, the gas retains its original volume. As in the case of ozone, heating destroys the allotropic modification which is believed to be formed. Moreover, the authors find that if the discharge is too violent and generates too much heat in the tube, the diminution of pressure in question does not take place.

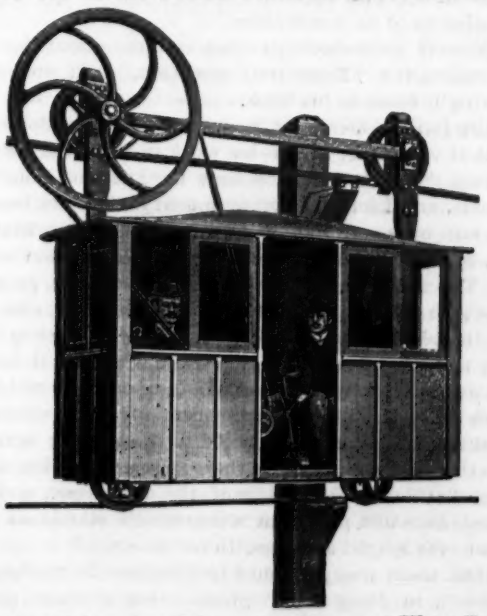


FIG. 3.—MOTOR FOR CHANDLER ELECTRIC WIRE ROAD.

Early Telephonic Apparatus.*

BY PROF. A. E. DOLBEAR.

It is recorded that Minerva sprang full armed from the brain of Jupiter. In very ancient times it was not a matter of wonderment that any event should happen without a natural history. In later times, however, there has been growing a conviction that events of all kinds have some ancestry, and if this is not so readily traceable in some cases, it has been believed that the obscurity is due to the difficulty of the search rather than the absence of genetic relations. If one may trust some sources of information to-day, our faith in the absoluteness of genetic ancestry must give way. The speaking telephone is the Minerva of to-day, and Prof. Bell is the Jupiter. The courts have solemnly declared that it has no ancestry, and those who sit at the receipt of customs are satisfied with the judgment. A hard-headed evolutionist might deny such a conclusion on general principles; and without either knowing or caring a button about the evidence or the lack of it, would declare the conclusion to be absurd.

It was reasonable to believe that the horse had geological precedents before Prof. Marsh had gathered the geneological series. Even then interested parties denied the conclusions and found two or three able men to help in the quarrel against nine-tenths of those competent to judge. There is no cure but death for such *lusus naturæ*, when they become interesting specimens upon the shelves of the psychologists.

If one, however, makes the inquiry as to what telephonic work was done before 1876 it is likely he will be surprised at both the work and the literature. I think it to be quite certain that but a handful of persons in this country had even heard of such a thing or had seen any of the publications containing descriptions of what had been made. As for myself, I never heard of such a thing until 1876. The journals containing the accounts were of small circulation and chiefly German and French.

On May 10, 1876, Prof. Bell presented a paper to the American Academy of Arts and Sciences at Boston on "Researches in Telephony," in which he exhibits his industry in searching out what others had done, for he refers to upward of 60 papers on the subject by others, aside from his own work.

It will be interesting to look over the literature existing before 1876 to see what one could have learned about telephonic apparatus, its structure, modes of operation, as well as the principles involved. Thus one will be able to compare the telephone of to-day with its antecedents.

In *Didiskalia*, Sept. 28, 1854, is a description of an apparatus for the "Electrical Transmission of Speech," by Charles Bourseul. The following is the part descriptive of the mechanism:

"Suppose that a man speaks near a movable disc, sufficiently flexible to lose none of the vibrations of the voice, that this disc alternately makes and breaks the current from a battery, you may have at a distance another disc which will simultaneously execute the same vibrations.

"An electric current traversing a metallic wire changes a piece of soft iron in the vicinity of which it passes into a magnet. As soon as the current ceases, the magnetic quality ceases. This magnet, the electro-magnet, can thus alternately attract or let go a metallic plate.

"It would be possible to so arrange this second metallic plate so that it repeated simultaneously exactly the same vibrations as the first plate, and it would then be exactly the same as if one had spoken in the immediate vicinity against this second plate, or the ear would be affected precisely as if it had received the tones directly through the first metallic wall."

A diagram (Fig. 1) will show at a glance the apparatus here described. I do not know whether young Bourseul ever constructed his apparatus or not, but he speaks with conviction as to its possibilities.

Du Moncel published this same account about the same time, calling it a "fantastic conception," and apologized for giving it room in his book.

Phillip Reis, of Germany, to whom we are indebted for most that was done, began his work in 1860 and 1861. I have met with no evidence that he knew of Bourseul's proposals, and I have the opinion that he had not heard of them, but began the subject anew. His transmitters, of which he made several varieties, embraced the same features. The following is Reis' description of one, as given in a lecture delivered in Frankfort-on-the-Main, and published in 1861, in the *Journal of the Physical Society:*

"In a cube of wood (Fig. 2) there is a conical hole *a*, closed at one end by a membrane *b*, upon the middle of which a little strip of platinum is cemented, as a conductor of the current. This is connected to the binding screw *p*. From the binding screw *n* there passes likewise a thin strip of metal over the middle of the membrane, and terminated here in a platinum wire, which stands at right angles to the length and breadth of the strip."

In 1863, there was published in *Böttger's Polytechnisches Notizblatt*, in *Dingler's Polytechnisches Journal* and in *Polytechnisches Centralblatt* the following description of Reis' transmitters. "A little light box, a sort of hollow cube of wood, has a large opening at its front side and a small one at the back on the opposite side. The latter is closed with a thin membrane, which is strained stiff. A narrow springy piece of platinum foil, fixed at its outer part to the wood, touches the membrane at its middle. A second platinum strip is fastened by one of its ends to the wood at another place and bears at its other end a firm horizontal spike which touches the other little platinum strip where it lies upon the membrane."

In a description of Reis' apparatus, published in Vienna in 1865, and now known as Pisco's, aside from the foregoing, there is the additional statement, "It is plain that the platinum strip may be replaced by a thin strip of brass and the platinum or steel points by iron ones," showing that

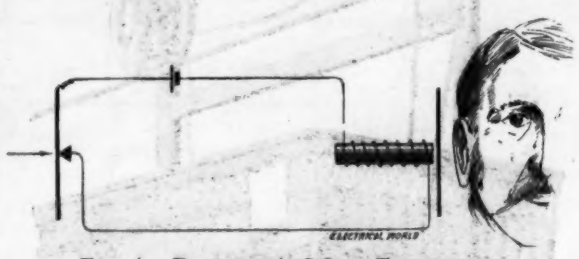


FIG. 1.—BOURSEUL'S IDEAL TELEPHONE.

the experimenters did not confine themselves to platinum terminals.

In many places a kind of transmitter is figured, consisting of a hollow cube with the vibrating parts affixed to the top in such a way that gravity keeps them in contact when they are at rest, instead of the spring needed and provided in the bored-block pattern. In a transmitter made among the first, and modeled after the human ear, there was provided an adjusting screw to maintain proper

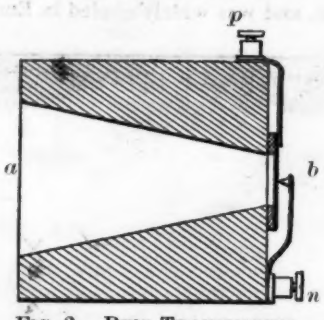


FIG. 2.—REIS TRANSMITTER.

tension between the terminals. A transmitter made by Reis and given by him to Professor Böttger has such a screw.

The Reis publications describe and figure two receivers, both operating by electro-magnetism, one utilizing what is called the Page effect, the other the inductive action of an electro-magnet upon an armature. The latter is thus described by Legat in the *Journal of the German-Austrian Association* in 1862. "The electro-magnet of the appa-

FIG. 3.—IRON CORE WITH PERMANENT MAGNET.

ratus, in accordance with the condensations and rarefactions of the column of air (in the transmitter), is correspondingly demagnetized and magnetized, and the armature of the magnet is set into vibrations like those of the membrane in the transmitting apparatus."

This description of the apparatus was published in a number of foreign journals, some making the account briefer and some expanding it and adding to it the work of other experimenters. Thus, in *Cosmos*, Vol. XXIV.,

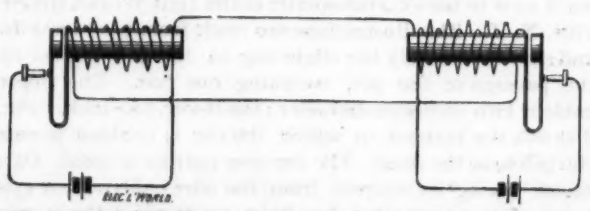


FIG. 4.—INDUCTION COIL AS RECEIVER AND TRANSMITTER.

1864, I find the following: We already know certainly that the intensity of the sound increases as a softer iron is used, because, in that case, the molecules have more freedom of motion than they had in the hardened iron or steel. If the iron core (Fig. 3) is magnetized by the influence of a permanent magnet or by another coil, its sound is more intense when the intermittent current is sent in such a direction as to produce a demagnetizing effect upon it, and it is less intense when the current is sent through the helix in such a direction as to increase the magnetism.

In a book published in 1872, called "The Wonders of Electricity," there is a description of the telephone by one named Baile. The receiver is thus described: "At the extremity of the line the current enters an electro-magnet which attracts a vibrating plate of size and quality identical with that in the transmitter."

A still more striking and important publication was contained in a foot-note to an article on "Disorders of the Spinal Marrow and their Treatment by Electricity," by Dr. Clemens in the *Deutsche Klinik*, No. 48, 1863, and is as follows:

"This most wonderful phenomenon of the transmission of sound in the electrified wire I have observed once before about ten years ago in the following manner. A strong induction coil was operated by one cell of battery and the current conducted above ground through a copper wire several hundred feet long from my study to a distant garden house. As soon as the wire thus extended was attached at the further place to a strong coil, one could hear in the farther coil quite distinctly the running of the machine and likewise perceive at the second coil any sound which was able in any way to set up strong vibrations. Shouting into a funnel, blows upon a metallic plate, etc., if directed toward the induction coil, were heard distinctly in the farther coil like the tones of an Eolian harp."

As the contributor was a physician, it was most probably an induction coil made for medical purposes, and such coils were then made with an automatic make-and-break operated by a magnet attracting an armature.

The primary circuit was through platinum contacts, one of which was fixed upon a flexible spring, while the other was an adjustable screw. It could operate, therefore, like the Bourseul and Reis transmitter contacts precisely, and could readily respond to forced vibrations.

The secondary coil, of course, had its proper function, as usual, and set up still greater difference of potential.

I was interested to try such a coil as a transmitter, and borrowed one that was thirty years old for the purpose. With an ordinary magneto receiver there was no difficulty in hearing many words with the receiver a foot or more distant from the ear. But this transmitter, Fig. 4, is interesting still further on account of the presence of the magnet and its armature capable of responding to forced vibrations; for such motions of the armature react upon the magnet, setting up magneto-electric waves in the coil, and thus conspire with the varying current in the primary to increase the effect. It is the magneto-electric transmitter combined with the variable resistance transmitter, and, furthermore, where two such instruments are coupled in one circuit, each provided with its battery, the primary circuit in the receiving instrument assumes the function of what has since been called the thermal telephone, and is in substance the same as Berliner's telephone of 1877.

If one recalls all that makes up the magneto speaking telephone to-day, in the transmitter, the vibrating plate of iron, the delicately movable electrodes, the battery of two or three cells, the secondary coil; and in the receiver, the electro-magnet of soft iron as a pole piece for a permanent magnet, the disc of iron about the same size as that in the transmitter, and still further thinks of the succession of changes, mechanical, electrical, magnetic and acoustical, which take place when being operated, and compare with these the corresponding ones described in these old journals, it will at once be obvious that there has not been a single new feature in the mechanism, or new principle in the mode of operation, added since 1875; and, however much the present telephones may perform better than the early ones, it is only a matter of degree. It will also be apparent that one who was acquainted with the literature on the telephone previous to 1876, was fairly well equipped for making telephones, and lastly he will be persuaded that the telephone of 1876 had a pedigree and was not a new creation.

*Read at the Buffalo meeting of the American Association for the Advancement of Science, August, 1886.

On the Chemical Behavior of Iron in the Magnetic Field.

E. L. Nichols, in the *Journal* of the Chemical Society, describes a set of experiments with aqua regia, nitric acid, hydrochloric acid and sulphuric acid, to illustrate the phenomenon that when finely-divided iron is placed in a magnetic field of considerable intensity and exposed to the action of the acid, the chemical reaction differs in several respects from that which occurs under ordinary circumstances. With aqua regia, it was found that the speed of reaction is greater in the magnetic field than without, and that the heat of chemical union is much greater. The production of nitrous fumes under the influence of the magnet, and the yellow color of the resulting solution, show that the reaction was modified in chemical character. With nitric acid, the effect of the magnet was to greatly increase the speed, reducing the average time from eight minutes to less than one minute. Red fumes always resulted from the action within the field. With hydrochloric acid, the rise of temperature was much smaller than in the experiments with aqua regia and nitric acid; the speed of reaction within the magnetic field differed very little from that occurring under ordinary circumstances; and the character of the reaction in the two cases was almost identical. The rise of temperature under the influence of the magnet, however, was found to be slightly in excess of that produced when the magnet was not in action. With sulphuric acid the reaction was uniform and complete, and apparently of the same chemical character within and without the fluid. The magnet was found, however, to increase the speed of reaction, and to decrease the amount of heat produced. A series of measurements was made with nitric acid, in which powdered copper was substituted for iron. The reaction in the field was found to be identical with that which occurred when

the magnet was not in action. The results arrived at by the author are shown in a series of curves; the ordinates denoting temperature in degrees centigrade, and the abscissæ time in minutes. The experiments are preliminary to a more complete investigation of the novel series of effects developed.

The Thomson Lightning Arrester and Am-Meter.

During the growth and extension of the Thomson-Houston system there have been occasionally noticed cases of injury to apparatus by induced discharges and lightning discharges of thunderstorms. During such storms the insulation of the dynamo was always imperiled, and it was soon seen that an efficient device preventive of damage by atmospheric electricity would soon be almost a necessity to the operation of lights from central stations.

The ordinary arresters, such as are used on telegraph lines, are not effective except when the machinery is at rest. When the lights are being worked, a discharge occurring to earth through the ordinary arresters, consisting of slightly separated plates, would, when two such arresters are used (one on the outgoing and the other on the return

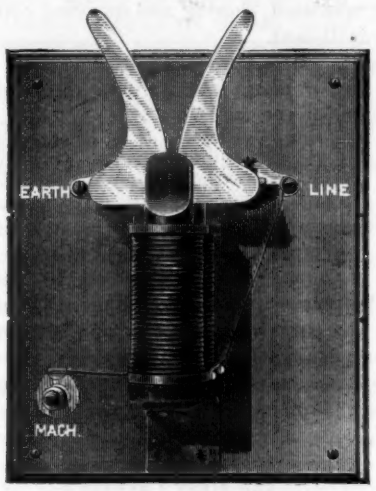


FIG. 1.—THE THOMSON LIGHTNING ARRESTER.

wire of the circuit), be followed by a practical short-circuit of the dynamos at the arresters, arcing and destruction of them.

Professor Thomson conceived the idea of combining with the separated plates of the arresters an arc-rupturing device near them for restoring the conditions after a discharge to earth from the line. He shows in his patent the use of a magnetic field, a jet of air and a mechanical separation of the discharge pieces of the arrester; but in constructing his arrester he has preferred the first of these methods on account of its simplicity and the absence of joints and moving parts, which are liable to fail from neglect to keep them clean.

The accompanying illustration, Fig 1, shows the Thomson lightning arrester for arc light and similar circuits. It consists of two curved plates separated from each other at their lower portions a distance less than $\frac{1}{16}$ inch. One of the plates, marked "Earth," is connected to a good ground, such as a steam or water pipe, when in use, and the other, marked "Line," is connected to the line to be protected. A large electro-magnet with flat poles, which are placed so as to have the curved arrester plates between them, is connected into the circuit. Its resistance is very low, and is inappreciable as such in the circuit.

One of these arresters is employed on each wire, outgoing and return. Should a discharge take place upon the line, it finds earth at the arrester plates, but so also would the dynamo current, and the result would be, were it not for the arc-rupturing device, *i. e.*, the magnet, a short circuit to earth through the arrester plates. The presence of the magnetic field in which the arrester plates are situated, immediately causes the arc or discharge thereat to move to a wider space between the plates, and soon the arc or discharge at the plates is ruptured or broken, the arrester remaining in readiness for protecting the apparatus from further discharges. The rupturing action by the magnet is instantaneous, taking much less time than is required to read the above description of the action.

Most of the Thomson-Houston plants are now protected by these arresters, and injury by lightning is a thing no longer heard of.

The arrester is also constructed for use on multiple arc incandescent lines, and the manner of use is much the same as above described. The magnet, however, is placed not in the main line, the current on which varies, of course, with the number of lights burning, but is placed in the circuit from the earth arrester plate to earth, and has no current, therefore, unless a discharge to the earth occurs.

Prof. Thomson has used permanent magnets in his arresters, but does not consider them as effective and reliable as the electro-magnets used.

The Thomson-Rice am-meter, as shown in Fig. 2, is an instrument designed especially for use in electric lighting stations to insure the maintenance of a standard current. It is made so as to be invariable in its readings, as it does not depend on permanent magnetism. Its deflections are given upon a scale by a pointer carried by a small soft iron disc mounted in agate centres on opposite ends of a diameter of the disc.

This disc moves between the poles of an electro-magnet whose cores are of very soft iron, and which when in use are saturated magnetically, or nearly so. Just alongside of the disc or needle is a small open coil, the plane of whose convolutions is parallel to the plane of the iron disc needle when the pointer is at zero. Both the electro-magnet coils and the small open coil are traversed by the current to be measured. The electro-magnet coils may be called the field coils and the needle coil the armature deflection coil.

The instrument is neatly mounted in a box outside of which is a switch which cuts off current from the instrument in one position, puts it only on the field coils in the next, so as to bring the index to zero, and in the third and last position puts current through the deflector coils. The deflection obtained is the resultant of the action of nearly saturated field magnets and that of the deflector coil upon the needle or disc carrying the index. The relation between these two forces remains practically invariable or unchangeable during any lapse of time, and the indications of the instrument when it is once calibrated by comparison with a standard, are to be relied upon.

A closely similar instrument is the Thomson-Rice voltmeter, the principle being very much the same, but the winding, being of very fine wire, permits the instrument to be connected by its terminals to the parts of a circuit, the difference of potential between which is to be indicated, such as the mains of an incandescent system.

Another similar instrument is the Thomson-Rice load indicator for incandescent circuits, which gives a reading showing the amount of load existing upon an incandescent main, its indications being proportional to the number of lamps in use at the same time.

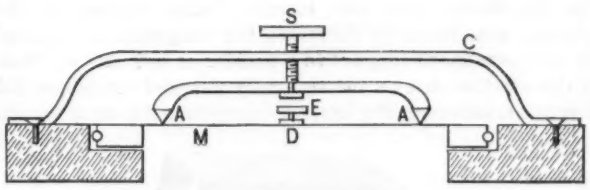
The volt indicator and load indicator differ only in winding proportions and connections from the am-meter above described, the principle remaining the same.

The Reis Telephone.

BY PROF. FRANCIS E. NIPHER.

It is conceded by all that Reis used his telephones to transmit the music of various instruments. Those who have had comparatively little experience with the Reis instrument have often been unable to make it do even this. After much experimenting with various forms of the Reis telephone, and with varied success, I was greatly impressed with a sentence in the letter of Reis to Ladd, given in Sylvanus Thompson's book on the Reis telephone. I quote this sentence from memory: "It would take me a long time to narrate my many failures, until I learned the proper dimensions of the parts, and the proper tension of the membrane."

It suddenly occurred to me that it was just here that Reis had touched the vital element involved in the successful working of his telephone. Acting on this idea I at



TENSION REGULATOR FOR REIS INSTRUMENT.

once made an adjustment, by means of which the tension of the membrane could be varied at will. The device is shown in section in the accompanying figure, in which *m* is the membrane, mounted on a brass ring in the usual manner. Above is a ring *A*, *A*, terminating below in a knife-edge, in contact with the membrane. This ring is carried on a diametral bar *B*, which is again supported on a swivel screw *S*. The screw is mounted in a support *C*, which is attached to the cover of the instrument. The working points are shown at *D*, *E*, in which *E* is either the angle-piece of the gravity instrument, or the spring of the bored-block form.

By turning the screw the membrane can be adjusted to any required tension. The best membrane is the one recommended by Reis—the intestine of a hog. If any one who has failed to work a Reis telephone will try this improved form, he will find why he failed. He will probably find, as I did, that he had been working with too tight a membrane.

With this device it is very easy to adjust the Reis telephone so that it will work at its best in transmitting musical sounds. It will then be found that the instrument will also best transmit articulate speech. Singing into it, "not too loudly," the listener hears the air and words. "*Any* sound will be transmitted, if strong enough to set the membrane into vibration."

After a little experience with the improved Reis, any one of ordinary skill can operate the common form. The essential thing is to get the proper tension of the membrane.

Western Union's Fighting Fund.—Mr. Gould is quoted as saying that he has $25,000,000 Western Union stock which he will not part with, and that the company is accumulating a dividend or fighting fund, whichever use it may be applied to.

The International Wire Gauge.

To the Editor of The Electrical World:

SIR: In your remarks upon my letter on wire gauges, in your issue of July 31, you seem to doubt my statement that the new British gauge is not in use in France and Germany. If my testimony is "in direct conflict" with that of Mr. Sise and Mr. Hotchkiss, so much the worse for those gentlemen! They should not have allowed their enthusiasm for the British gauge to lead them into making such careless statements.

I have read the proceedings of the Providence Telephone Convention, and have marveled not a little at the misinformation on wire gauges presented to that body. Of course, it was all wellmeant and in perfect good faith, but where Mr. Sise could have got his erroneous impressions I cannot imagine. The fact as to usage on the Continent is simply as I stated it—that the general practice is measurement in millimetres. As my business brings me into relations with manufacturers and telephone companies in nearly every country in Europe, I am in a position to know whereof I speak, which is entirely a matter of fact and not of opinion. But if you wish further "testimony"

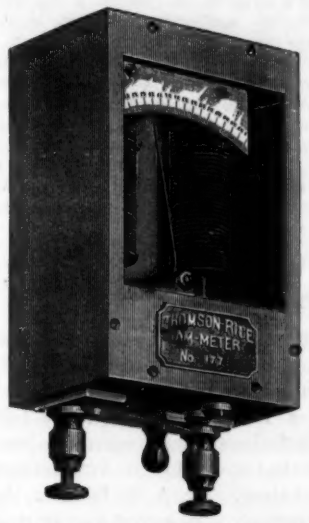


FIG. 2.—THE THOMSON-RICE AM-METER.

I will promise you as much of it as you like. See, for example, the following letter from MM. Houry, Aboilard & Co., (Ancienne Maison Bonis), of Paris, the largest manufacturers of fine magnet wires in the world:

[COPY.]

PARIS, Aug. 10, 1886.

DEAR SIR: The English wire guage has never been in use here, and without exception all the orders we get from the different nations on the Continent indicate in hundredths of a millimetre the size of the wires ordered. In England the best telegraph and telephone manufacturers, when ordering from us, always use hundredths of a millimetre. [Signed.] HOURY, ABOILARD & CO.

In French and German books and periodicals you will find the dimensions given in millimetres and hundredths. See, for example, Wietlisbach's "Technik des Fernsprechwesens," just out, the best book on the telephone yet published. The measurements are invariably in millimetres, as they are in all the rest of the volumes of Hartleben's "Electrotechnische Bibliothek."

But it is hardly necessary to specify examples, for the usage is pretty nearly uniform and universal in Europe—outside of Great Britain—both in practice and in theoretical and practical writings. If you desire more evidence on the subject, I will undertake to obtain you a dozen or so of letters from competent authorities, from one end of Europe to the other, although it is taking a deal of trouble to establish a fact which nobody on this side of the water would think of disputing.

F. R. WELLES.

BELL TELEPHONE MFG. CO.,
ANTWERP, Belgium, Aug. 13, 1886.

The Construction of the Subway Begun.

The recent resignation of President Fitzhugh, of the Consolidated Telegraph and Electrical Subway Company, has not yet been followed by the election of a successor to the office. In the mean while, however, a permit has been granted the company by the Commissioner of Public Works to open the streets and lay the conduit, and as a preliminary survey Engineer Kearney, of the Subway Commission, and a representative of the Consolidated Company dug up the pavement in three different places on Sixth avenue, between Twenty-third and Twenty-sixth streets. One trench was dug on each block from a pillar of the elevated road to the curb line of the avenue. After a careful examination it was decided that the conduit should be laid about 12 feet from the curb line, at an average depth of 4½ feet. On some blocks the conduits will be 7 or 8 feet below the grade and never less than 4 feet from the surface.

A contract has been entered into between the construction company and Mr. John D. Crimmins, the contractor, to do the work of excavating, which was begun at the east side of Sixth avenue, north of Twenty-Third street on the morning of August 31.

The first stone was lifted from the pavement by Commissioner Theodore Moss, in the presence of a large num-

ber of people, and it is intended to keep the stone as a memento of the inauguration of a great public work. Some slight modifications from the original plans, illustrated by us recently, have been decided upon in the manner of laying the conduit. The walls along the sides of the conduit will be lined with brick, the use of which was only determined upon at the last moment, when both Engineer Kearney and the contractor agreed that the conduits would be easier to come at for necessary repairs if sided with brick, instead of concrete. The work is being pushed vigorously, a large force of laborers being set to work at excavating.

The conduit now being laid provides only for telegraph and telephone wires, it being intended to place the electric light wires in a separate conduit on the other side of the street.

During the course of the day the following document was received by Commissioner Moss:

DEAR SIR: We beg to inform you that we have been retained by the North American Underground Telegraph and Electric Company, and after a careful examination of the letters-patent of the United States owned by them, we have advised them that if the specifications called for by the Electrical Subway Commission are followed (in the construction of a system of conduits for the operation of electrical conduits underground) it will constitute a flagrant infringement of said letters-patent.

We accordingly notify all concerned in the carrying out of the plans and specifications of said Electrical Subway Commission, or in the constructing or laying or aiding in constructing or laying of any such system of conduits in the form above mentioned, that we shall hold them liable for all damages caused to this company by such infringement, and we shall exercise our rights to have them enjoined from any further violation of the patents owned by this company. Respectfully,

JOHN R. DOS PASSOS,
GEORGE HARDING, } Attorneys.

TO THEODORE MOSS, Esq.

At the last meeting of the Commission the engineer, Mr. John Thompson, informed them that he was not as yet ready to report as to what arrangements should be made for the care of incandescent and arc light wires under ground. Commissioner Hess wanted some arrangement made soon, so that it would be unnecessary to open the streets a second time. Dr. A. R. Ledoux, the chemical expert of the Commission, reported that in the public tests of concrete all three classes of bituminous material in the market had been represented. Any of them might be safely chosen by the commission. Tests for tensile strength and comparative tests as to contraction and expansion of the samples are yet to be made by Col. Kearney.

Dr. Ledoux submitted additional requirements of the concrete conduits and read a letter from Mr. W. O. Callender, who maintains that only pure asphalt should be used in the manufacture of the conduit.

A new complication has arisen in the application of the New York Electric Lines Company, of which Mr. Sidney F. Shelbourne is president, for a mandamus to compel the Commissioner of Public Works to issue to the company a permit to open the streets and lay conduits of their own without respect to any privileges granted to the Consolidated Telegraph and Electrical Subway Company, acting for the Commission. The hearing of the application came up before Judge H. Wilder Allen, in Common Pleas, Chambers, on Aug. 26, and the court room was thronged with people more or less interested in subways.

Mr. Roger Foster, appearing for the Electric Lines Company, argued that the latter had incorporated itself regularly under the general law; had applied to the Common Council for the franchise of laying its lines under the streets of this city, and had obtained it upon engagement to pay the city the rent demanded for the use of its streets; having obtained this contract it expended $25,000 for the implements and material needed for the purpose, and had contracted to pay a similar amount for what else was needed, and was ready to go to work. All these acts and facts, he concluded, made it a corporation with a valid franchise. All had been accomplished prior to the legislation which constituted the Subway Commission. The acts making the Subway Commission, he argued, were unconstitutional, for they tended to impair the franchise which had accrued to the company making the application.

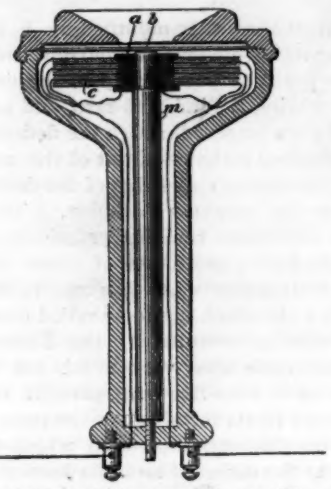
Furthermore, the Commission was the creature of an unconstitutional act, in that it was empowered to tax, for its salaries and expenses, certain telegraph companies which had not been consulted in the matter and were entirely opposed to such Commission. This also is contrary to section 14 of the State Constitution, and consequently void. Hence he argued that any contracts made with the Commission were void and worthless, and that the Electric Lines Company stood alone prepared to lay lines, which they expected to hire to such companies as might need them to comply with legislation compelling them to go under ground. All that was lacking was the formal permit of the Commissioner of Public Works, who, he argued, should be compelled by the Court to do this ministerial act.

Mr. Lacombe, the Corporation counsel, in reply, complained of the shortness of the time given him to prepare an argument in the matter. He criticised the fact that the morning papers did not contain the certificate of incorporation of the Electric Lines Company, nor any evidence beyond the statement of counsel that it had acquired the franchise. This aside, the question turned upon whether the act creating the Subway Commission was constitutional, and he argued that similar acts had already been declared valid by the highest courts, and no doubt would be similarly sanctioned in this case.

Mr. Gibbens, counsel of the Subway Commission, then addressed the court, which took the papers in the case and reserved its decision.

A Novel Receiving Telephone.

The most general form of receiving telephone in use is the magneto in which the variations of current induced in

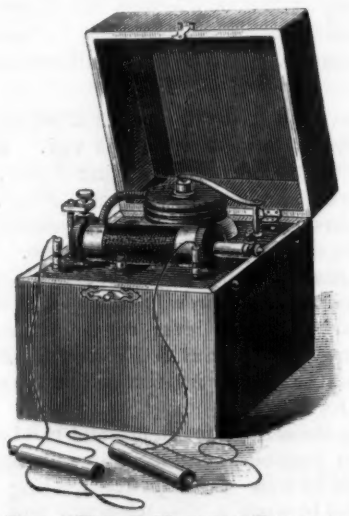


COMBINED SPEAKING CONDENSER AND MAGNETO TELEPHONE.

the line and coil react upon the magnet so as to influence the diaphragm. It was noticed, however, that condensers would also act as receiving telephones, and Prof. Dolbear has embodied this in his very simple arrangement of two freely moving plates placed near each other and connected directly to line. As this latter arrangement does not permit of the passage of a current, the action being merely due to the static charge received by the plates, Mr. Orazio Lugo, of New York, has conceived the idea of embodying both of these known methods in one instrument.

The accompanying illustration shows the new telephone in section. It contains the usual permanent magnet, and, in addition, the speaking condenser *c*, which consists of metallic plates, which are insulated from each other by paper or other dielectric. One side of each alternate plate of the condenser goes to line, and also connects with one terminal of the coil *a*. The opposite plates of the speaking-condenser *c* connect with the other terminal of the coil as well as with the line wire.

Mr. Lugo, who has recently patented this form of telephone, states that it is particularly adapted to long-distance telephony for the reason that the speaking condenser being kept charged with a sufficiently strong galvanic battery in the line wire it will reproduce speech, besides reacting on the magneto telephone. The reaction of the condenser upon the magnet being inverse to its charge, it increases or decreases the magnetic saturation of the permanent magnet to a greater or less extent than if the reaction due to the statically charged condenser did not exist, inducing the latter to reproduce the same speech



THE "FINK" MEDICAL BATTERY.

or signals, which would otherwise most probably have remained silent.

The number of plates in the little condenser need not exceed forty or fifty, and the diaphragm may have a few perforations in order to better hear the condenser speak.

The Fink Medical Battery.

Physicians everywhere are studying and applying electricity in their practice more and more every day, and electrical treatment is an equal favorite of both the homeopathic and allopathic schools of medicine. The Messrs. Fink Brothers, of this city, have lately brought out a compact form of medical battery constructed especially for easy manipulation. The battery is well adapted for medical application at home, where many cures can be effected under the guidance of a good physician.

An Experience with the Telephone.

To the Editor of The Electrical World:

SIR: Some time ago, while standing in proximity to a telephone instrument, the receiver of which was in its usual place on the hook provided for it, the bell was rung by some station on the line, and immediately after I heard at a distance of several feet the conversation which was being carried on over the line, and which ought to have passed through the coils of the ringer only.

Thinking that the automatic hook did not properly cut out the receiver, and that the sound came from that source, I held the receiver to my ear and, holding the hook down, found the sound to emanate from the bell box. I then removed the receiver entirely from the apparatus and heard the talking as before.

I next disconnected the transmitter entirely, the receiver still being disconnected, first requesting the central office to talk over the wire, and found that I could hear every word distinctly.

I removed the magneto bell and subjected it to a series of tests with like results in each instance.

The bell has been tested as to its talking power by several persons. At times, when an exceptionally good transmitter was used, singing and speaking could be heard several yards distant.

The ringer magnets are wound with number thirty-two wire, and are of about thirty-five ohms resistance, or seventy ohms for the two.

I should like to know if any of your readers have ever had a like experience. B. C. WOLVERTON.

ELMIRA, N. Y.

[The phenomenon observed by our correspondent is not a new one. Reis' original knitting-needle receiver is the equivalent of the magnets in the bell box in this case. Probably the reason in our correspondent's particular case is that the box containing the magnets has some peculiar, resonant properties which amplify the sounds emitted so as to make them audible. Reis, it will be remembered, mounted his "knitting-needle" upon a sounding box.—EDS. E. W.]

The Gray Caveat.

To the Editor of The Electrical World:

SIR: I note your article entitled "The Gray Caveat," in the issue of Aug. 28, 1886. You there state that Edison and Berliner have the interference on the carbon telephone transmitter delayed in its progress; and state, further, that it would appear that the object was to obtain a seventeen-year patent, and thus corral a new monopoly to the Bell Company after the Bell receiver patent is about expired. Edison has a foreign patent covering this device, hence, if the decision is rendered in his favor, the patent so issued must expire with the earliest expiring foreign patent, and this life could not be more than fourteen years from the date of his English patent, which, if issued in 1879, would make the United States patent expire in 1893, or in seven years from now; and if the taxes on the English patent are not paid the patent might expire before that date. The only danger lies in the fact that after the expiration of the life of the Bell patent, a decision will be given in favor of Berliner, who has no broad foreign patent, I believe, in which case the monopoly could be made to stand. This would seem the most probable outcome of this intentional prolongation of the interference.

PHILADELPHIA, PA. R. M. HUNTER.

Rogers Files His Reply.

The answer of J. Harris Rogers to Attorney-General Garland's cross bill in the suit of the former against Mr. Garland for damages growing out of the Pan-Electric controversy, was filed in the Superior Court of the District of Columbia on Aug. 27. Mr. Rogers denies all the allegations which are intended to support the defendant's prayer for a "dissolution" of the Pan-Electric Telephone Company. He denies that he ever sold any stock contrary to his agreement as set forth in Garland's answer, and pronounces false the allegations which accuse him of violating his contract. He denies that he was ever bound by any contract or promise to devote himself to the perfection of his various inventions, or of any invention; but, on the contrary, was as free as his associates or copartners, the defendants, to pursue any avocation whatever; but, nevertheless, did toil in his laboratory incessantly for the company, while they contributed nothing, except that, equally with himself, all the defendants paid some pitiful sums to mechanics, electricians, etc., he always advancing his ratio of four-tenths of the money and in some instances all the money, when the defendants were short of funds.

The respondent denies that he ever "procured false and malicious statements to be published in the press of the country, both as to the defendant and the company," and submits to the Court that since the defendant "never reads the newspapers," according to his own frequent statement to reporters, he has been imposed upon by some malicious person, and calls upon him to produce in court a single line or word derogatory to the defendant or the company which respondent has caused to be published, except in his original bill of complaint.

The respondent admits, as set forth in Garland's answer

that he is wholly "unreliable," if it be meant that corrupt politicians cannot rely on him to co-operate with them in their nefarious designs to run the United States Patent Office and the Department of Justice under secret compacts to advance private interests, as charged in the bill of complaint; but if he meant that honorable men cannot rely upon him, he denies the allegation, and, in proof of such denial, refers to exhibits filed with and prayed to be made a part of his answer.

The exhibits referred to are letters produced during the Pan-Electric investigation, written by Messrs. Garland and Harris, recommending Mr. Rogers to S. S. Cox, Abram S. Hewitt and Professor Baird, and a petition recommending Mr. Rogers to the President for appointment as one of the scientific experts to be appointed to the Paris Exposition, signed by all the other defendants except General Joseph E. Johnston and Mr. Garland.

The respondent submits that so exalted a personage as Mr. Garland should not, at this late day, swallow his own words or prejudice the reputation even of an obscure young man who had done him many favors, as set forth in the original bill of complaint and admitted by defendant's answer. The respondent further denies the justice, propriety or expediency of "dissolving" or "winding up" the Pan-Electric Telephone Company, for which purpose it is sought to make the defendant's answer a cross-bill, and the deponent advises the Court that such a dissolution would be disastrous to all parties concerned, except the defendants, whose stock is really the property of the respondent, as shown in his bill; that it would entail irremediable losses on this respondent, on hundreds of innocent stockholders in the parent company and also in the subordinate companies, whose stock has been sold, in many cases, to widows and orphans and their money transferred to the pockets of defendant Garland.

The respondent further submits to the court that when the defendant gives as his reason for such "dissolution" that he wishes to get rid of the respondent, he contradicts his own statement, to wit: "The said complainant, as defendant is informed and believes, and so charges, has sold or disposed of a large part if not his entire interests in said joint property, * * * and has realized some $40,000 or $50,000 for the same." The respondent therefore submits that the pretext aforesaid for "dissolution" is a mere sham, conceived in malice and born in falsehood. He further submits that the Pan-Electric Telephone Company is no party to this cause; that the right to subpœna is as old as equity practice, and that even an attorney-general is bound to bring parties into court before their cause can be tried. And finally the respondent submits that all the allegations of the defendant in his behalf, intended to support a monstrous proceeding as aforesaid, are not only untrue and reckless in the extreme, but most impertinent and scandalous.

On the same day also Senator Harris and Commissioner Joseph E. Johnston filed demurrers to the plaintiff's bill, setting forth that the bill is bad in substance and lacking equity. The matters of law or equity intended to be argued in support of the demurrers are set forth as follows: First, that there is no equity in the bill; second, that the bill is uncertain, vague, ambiguous and indefinite, and sets up no equitable right in plaintiff violated; third, the bill is multifarious; fourth, it is defective to parties defendant to the bill; and fifth, plaintiff has an adequate remedy at law for any injuries which he has suffered under the allegations of the bill.

Telephone Capital and Earnings in England.

The telephone companies in England are making slow headway, but are nevertheless showing improvement. The United Telephone Company is the principal corporation, and like our own American Bell has an interest in nearly all the minor companies. In fact the United Telephone Company holds shares in seven subsidiary companies, to the nominal value of no less than $3,273,750, made up as follows:

National Telephone Company, ordinary shares	£225,000	$1,125,000
Lancashire and Cheshire Telephone Exchange, ordinary shares	50,000	250,000
Northern District Telephone, ordinary shares	37,500	187,500
Telephone Company of Ireland, ordinary shares	87,500	437,500
Western Counties and South Wales Telephone, ordinary shares	160,000	800,000
South of England Telephone, ordinary shares	93,750	468,750
National Telephone, pref. shares	1,000	5,000
	£654,750	$3,273,750

Upon this capital of $3,273,750 the United Telephone Company only received about $56,280, or less than two per cent., last year, on the average. Some of the older companies did better, while others scarcely earned expenses.

The progress of telephoning in England may be seen to some extent in the following showing of dividends earned by the National Telephone Company. This is the largest sub-company, and one of the oldest, it having been organized in March, 1881. Its dividends on common or "ordinary" stock have been:

	First half-year.	Second half-year.
1882	nil.	nil.
1883	nil.	nil.
1884	1 per cent.	1½ per cent.
1885	2 "	2½ "
1886	3 "	3½ "

This company has not reached a seven per cent. basis in five years.

The Lancashire & Cheshire Company, which started in May, 1881, is also doing better. The accounts for this year have not been presented, but for a good while past the dividends have been on an advancing scale, namely, 1881-2 and 1882-3, 5 per cent.; 1883-4, 6 per cent.; 1884-5, 7 per cent.

The Northern District Company has had difficulties with the Government; but these have been removed. For obvious reasons the Telephone Company of Ireland has not had an opportunity to get out of the rut of dividends averaging only ¾ per cent. per annum. The Western Counties and South Wales Company was only registered on Dec.

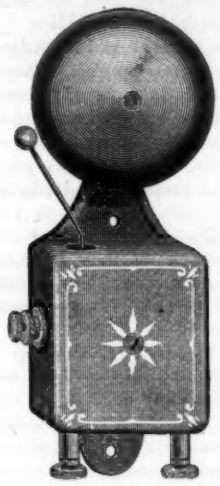


FIG. 1.—A NOVEL BOX-BELL.

17, 1884, so that there has been no time yet to see what development its business may have, and the same may be said of the South of England Company registered Jan. 29, 1885.

In the case of the parent company, the United Telephone, registered June 10, 1880, the dividends have been as follows: 1881-2, 5 per cent.; 1882-3, 6 per cent.;

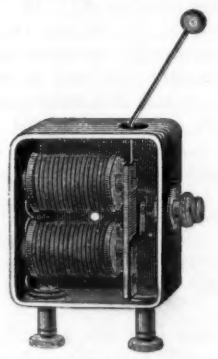


FIG. 2.

1883-4, 8 per cent.; 1884-5, 10 per cent.; 1885-6, 13 per cent.

A Novel Box-Bell.

Even the best apparatus requires periodical inspection especially when situated so as to be under influences

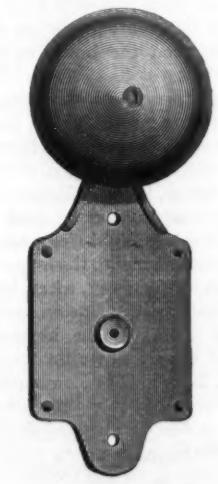


FIG. 3.

which tend to lessen its working qualities. The ordinary vibrating box-bell is no exception to this rule, and hence a ready means of inspection is a desirable quality. With this idea in view, Messrs. E. A. Wildt & Co., of this city, have recently designed a vibrating bell in which the operating parts can be entirely removed so as to allow of convenient search for any disorder. The bell complete is shown in Fig. 1 of the accompanying illustrations, and Figs. 2 and 3 show the parts separated. As will be noted, the back carrying the bell is permanently fixed to the wall, and the box containing the mechanism can be entirely removed, being held in its place by a single screw through the centre. Inspection is thus greatly facilitated, and any fault can be quickly remedied. The bell is gotten up very neatly, the binding posts and regulating screw being nickel-plated so as to withstand the influences of the weather.

The Dangers Arising from Electric Light Wires, and the Underground System.

At the Convention of Fire Engineers, held at Providence last week, Prof. John D. Barrett, Superintendent of the Chicago Fire Telegraphs, read a paper on the above subject, in which he showed under what conditions an electric light wire may become dangerous to life or property. To remedy both, he advocated the rigid inspection of lines by a competent party, who should be clothed with authority to compel obedience to his just requirements. Speaking on the subject of underground lines, Prof. Barrett said:

"It has long been my conviction that the proper place for electric wires in a large city is under the surface of the earth. Especially is this true of fire and police wires. In a system from which so much is expected, where a single broken wire may cause a delay in giving an alarm, involving a loss of thousands of dollars, it seems to me that we should have the wires in a place where wind, sleet and sulphurous gases cannot harm them. To be perfect, a fire alarm system must be certain. It should be an absolute certainty that, when the hook in a fire alarm box is pulled down, an alarm will be given to which the department will respond. We cannot have this certainty in our present system of aërial wires strung in the neighborhood of hundreds of other wires, subject to the destructive action of smoke and storm, liable to accident from countless causes; there is no reasonable certainty that at the time a box is pulled, the line to which it is connected is not open or crossed in such a manner as to render it for the time being useless. With a wire of suitable conductivity, well insulated and protected from mechanical injury, placed under ground, we will have this certainty, which the air line cannot give. This is the way I feel about underground wires, and I am backing up the faith that is in me by planting those of the Chicago fire and police alarm telegraph as fast as I can get money to do it with. With me it is not a question for hair-splitting argument. It is a question of money, of first cost; outside of that everything is in favor of underground and against aërial wires, and that seems to be the general sentiment. All over the country we see or hear of preparations to get wires down, although some of the telegraph companies are moving in that direction very reluctantly; still they are moving, and we may hope to see at no distant day all, or nearly all, of the poles and wires removed from the street and air, and when I tell you that up to July 1 of this year the city of Chicago and the various companies interested have taken down 608 poles and removed 917 miles of aërial wires, you will understand we have made a mighty stride in favor of the underground system. In Chicago the agitation of underground wires commenced about the year 1875 or 1876, and in the year 187 we laid our first underground wires. The work was performed under my supervision. We put down 840 feet of iron pipe, treated inside and out with a liberal dose of Stockholm tar, and through this we pulled two kerite wires. These proving satisfactory, the agitation was kept up, and a law was passed in 1881, to take effect in 1883, compelling all corporations and individuals owning or controlling wires within the corporate limits of the city to place them under ground. In order to accomplish the requirements of the law, it was necessary to do away with the concessions which had been made by the authorities to the companies. It has been a work of time, perseverance and ingenuity, but it is now well under way, and we have underground systems of several kinds, iron pipes, wooden boxes filled, some with asphaltum, others with cement, etc."

Prof. Barrett then gave a detailed description of the methods employed by him in placing the wires in the various conduits, and spoke enthusiastically of the excellent condition in which they have been preserved for a number of years past and predicted their continued successful working.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Aug. 30, 1886.

To prove to my own satisfaction the wonderful growth of a new industry, I visited the city of Plainfield, N. J., where, in company with Mr. Alex. P. Wright, the able superintendent of construction of the Westinghouse Electric Light Company, I had an opportunity of thoroughly inspecting the admirably arranged electric light station now about completed. In passing through the business portion of the city I had an opportunity of casually examining the outside work thus far completed. There are forty-five stores wired for the incandescent light, and in some instances, where required, the wires were all concealed from view.

Mr. Wright met with some difficulty in placing the poles on the streets, but he has succeeded in robbing them of their usual unsightly appearance. The poles are all finely finished and painted to resemble the trees. In fact, the illusion produced is such that from a distance their true character cannot be detected; and I must confess that I myself was deceived until my attention was specially drawn thereto. Plainfield is noted for its picturesqueness, which is not in the least detracted from by the poles.

The station itself is a model one in every respect, and reflects great credit upon Mr. Wright. It is built of brick, having a front of 100 ft. by 50 ft. deep, with the side facing the Philadelphia & Reading Railroad. There are three boilers of 150 h. p. each, and adjoining are two driven wells which furnish the water required. Immediately facing the boilers there are openings in the wall from which chutes extend to the railway tracks 25 feet off. Coal can, therefore, be transferred from the cars directly into the boiler room without handling and hence without extra expense.

The dynamo room, when completed, will be the equal of any in the country in its appointments, being finished in Georgia pine to the ceiling. Up to a height of 6 feet it will be wainscotted in black. Mr. Wright proposes to fresco the ceiling in neat colors. Foundations have been built for several Westinghouse automatic high-speed engines, one of 150 and one of 75 h. p. being already in place, together with the Thomson-Houston dynamo, which will be used for arc lighting.

No pipes will be visible in this room, nor will an oil-can be seen in it. A large oil-tank will be put overhead and pipes run to the bearings of all the engines and seven dynamos which will soon be in place. A drain will be provided to receive all the drippings, which will be conveyed to a converter on the outside, in which all the waste oil will be received, purified and used over again.

Ventilation has been well provided for in the placing of windows at the top of the walls of the station. The large chimney has also been utilized by placing a platform upon it at the level of the roof, and distributing the wires from this point, thus doing away with frames and brackets.

The station is expected to start up on Saturday, September 4, with 75 arc and 1,000 incandescent lamps. The charges for stores vary with the number of lamps used and the hours of closing, being on an average $1.75 per month.

Mr. Wright expects to light the railroad station, and has already wired all the hotels, many of the residences, stores, livery stables, etc. I predict a great success for the undertaking.

Electric light companies and individuals operating dynamos know of the necessity of maintaining uniformity of operation in their plants to secure good and economical lighting, and a record of the work done is highly desirable. The Moscrop Continuous Recorder gives a continuous indication of the speed of the engine upon a chart which can be kept for reference at all times. These charts, which cannot be tampered with by employés, show at a glance whether their duties have been performed faithfully.

These recorders, which are made by the Ashcroft Manufacturing Company, of No. 111 Liberty street, this city, are in use in quite a number of central stations and isolated plants where they have given good satisfaction. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Aug. 30, 1886.

The authorities of Attleboro, Mass., recently voted to light the entire fire district by electricity. A special town meeting was held on Friday, Aug. 27, and speeches were made calling upon the authorities to light the main thoroughfare with arc lights between the towns of Attleborough and North Attleborough.

At the electrical building at the torpedo station, Newport, R. I., last week, the Naval Institute held an important meeting, when Commander Barker, U. S. N., read a paper on experiments with high explosives, conducted by himself. Commander Barker had a large audience of naval officers, including professors of the torpedo station, Captain Sampson, the commandant, who, on Sept. 7, will be detached and will assume command of the naval academy, and general members of the torpedo class.

The Curtis Regulator Company, of Boston, has perfected a patent damper regulator, which merits the notice of the electric lighting fraternity. In speaking of this improved and highly useful apparatus, Mr. Curtis said to me: "The grand difference between our new regulator and all others is, that we can avail ourselves of the entire boiler pressure to do the work, instead of a single pound to the inch on a given area; and can control any damper, with a slight variation of boiler-pressure, regardless of ordinary friction." Mr. Curtis also stated that among his patrons in the electric lighting field are: the U. S. Illuminating Company of New York, and the Brush and Merchants' Electric Light Companies of Boston, Mass.

The Jarvis Engineering Company, of Boston, Mass., has shipped this week the sixth Armington & Sims engine to the New Haven Electric Light Company. An order is in hand for a 90 horse-power engine of the same make to be delivered in a few weeks. This electric light company is one of the best managed in New England. It was formerly run at a loss and purchased at a low rate by its present owners, who adopted the Thomson-Houston system. The steam plant was reconstructed and remodeled by the Jarvis Engineering Company, who put in Armington & Sims engines and reset the boilers with the Jarvis boiler setting. Since the change it is said that this plant has earned an average of over 18 per cent. profit.

The Eastern Electric Cable Company, of Boston, reports business as being unprecedently good at its works. Many of the leading electric light companies have been for some time using the insulated wire manufactured by this concern, and are repeatedly duplicating their orders. The product of the company is manufactured under the management of Mr. H. A. Clark, who is well known throughout the electrical field. Among the valuable features possessed by the insulated wire made by the Eastern Electric Cable Company is, that it does not deteriorate, oxidize, or crack, always remains flexible, and is water-proof, acid-proof, oil-proof and to a considerable extent fire-proof.

The Boston Electric Company has just finished putting in the last installment of new machinery in its enlarged premises. At the present time the manufacturing facilities of the company are more than double that of last year, and the number of employés has been increased from less than fifty to nearly one hundred. Two buildings, comprising four floors each, are now occupied, and to the observer it is clearly apparent that every foot of space is being utilized. The offices and showrooms are in every respect a credit to the Boston Electric Company, and any of the electrical fraternity visiting the "Hub" will be amply repaid by a call of inspection at these handsome quarters.

Mr. C. C. Allen, the treasurer and manager of this company, stated to me recently that as a demand for electrical novelties is now on the increase by dealers in electric goods and supplies, his company intended in the future to make that line one of the leading features of its manufactures. This will not in the least interfere with the extensive manufacture of the various lines of electrical goods which have made the Boston Electric the popular and largely patronized concern that it is to-day.

The variety of these novelties referred to is so extensive, and the standard goods are so numerous, that it has been decided to fit up the walls of the offices and show-rooms with immense sideboards, containing samples of every article, device, instrument and apparatus manufactured by this enterprising company.

The new electric light company, recently formed by residents of Roxbury, is making preparations to commence operations, nearly all of the stock having been sold.

The steel boiler of the Charlestown Gas & Electric Light Co., Charlestown, is being set with the Jarvis boiler setting and Sheffield grate bars to burn coke screenings and railroad cinders. They will use a Korting injector and National feed-water heater.

The New Haven Electric Light Company have ordered from the Jarvis Engineering Company, of Boston, the second 90 h. p. Armington & Sims Company engine, making eight of this type of engine they will use in their station. They are going to introduce incandescent lights, and also sell power, using Sprague motors.

Messrs. Seth W. Fuller & Holtzer are making rapid progress with their new electric gas-burners, and will soon have on hand a large and varied stock in this special line.

The Electrical Development and Manufacturing Company is at present working a large force nights, in addition to the sixty men who are kept busy in the daytime. It is said that this company has orders now in hand for American arc-lamps and call-boxes, sufficient to keep its employés busy for the next three months.

The Merchants' Electric Light and Power Company is entering energetically into that branch of its business whereby power can be transmitted direct from its station on Congress street to any section of Boston. The company is prepared to rent power in large and small quantities, as may be desired, for running all kinds of machinery, such as elevators, ventilating fans, printing presses, sewing machines, also for wood-working and iron-working machines.

The New York Insulated Wire Company reports: "Information has been received from a reliable source that two large manufacturing concerns had entered into the making of an insulated covering for wire and cables, closely resembling the Grimshaw tape, of the patents on which this company is the sole owner." Many electric light and telephone companies in this country and abroad are showing their appreciation of the Grimshaw wire and tape by duplicating orders previously filled by the New York Insulated Wire Company.

The Redding Electrical Company is making a specialty of experimental and model work; and its large manufacturing facilities—backed by a familiarity with the wants and requirements of inventors—enables this company to give thorough satisfaction in this important branch.

The Wainwright Manufacturing Company, Boston, Mass., and New York City, are erecting plants for the purification of feed-water for boilers on the premises of C. W. Lyman, Somerville, Mass., and S. N. Brown & Co., Dayton, Ohio. Their process of purifying water before it enters the boilers is very effective, and a large field is being rapidly developed in this line of their business. They have recently sold feed water heaters to the Thomson-Houston electric light companies in the following cities: in Northampton, 100 h. p., in Lynn 400 h. p., and in Rutland, Vt., 300 h. p. The corrugated tube expansion joints made by this company are finding great favor among electric light people. The corrugation gives great longitudinal flexibility, and absorbs the strain caused by the contraction and expansion. The officers of the Brush Electric Light Company, of Buffalo, N. Y., whose plant is a fine one, speak of these joints very highly, having them in use in their station.

In a recent interview with Mr. H. McL. Harding, the N. E. manager of the Sprague Electric Railway and Motor Company, my interlocutor said: "Our company has just sold one of its 2 h.-p. automatic non-sparking electric motors to be used in the London (Eng.) post-office for running stamp-canceling machines. Recently, we put one of our motors in the Union Institution of Savings building, in Boston, to be used for giving power to the elevator; this being, it is said, the first electric elevator introduced in New England. The President of this bank (Mayor O'Brien, of Boston) is also the President of the local Brush Electric Light Company. The Sprague Company has now sixteen motors, varying in size from ½ h.-p to 7½ h.-p., running successfully in Boston from the Central Station of the Edison Electric Illuminating Company, and the books of the company show a large number of orders yet to be filled. The work done by the motors already in use comprises elevators, circular saws, machinery and large printing presses." Mr. Harding predicts that "at an early day the revenue derived from power service alone furnished from the Edison station will more than defray the entire expenses of the station, both for lights and power." The Fall River Electric Light Company has adopted the Sprague motor, and the Springfield Electric Light Company has given orders for several motors of the same make, the largest being 10 h.-p. The Taunton Electric Light Company, after having used a Sprague machine for some time past, wrote an unsolicited testimonial to Mr. Harding, which contained the highest encomiums on the motor and a report of the good results obtained.

Mr. A. L. Wright, Lowell, Mass., manufactures engine lathes which are especially adapted for use in factories of parent electric light companies and in the shops of electrical manufacturing concerns. These lathes have been very carefully designed to meet the demand for a strictly first-class tool capable of doing the finest work. They are built from new patterns and are designed to do heavy work at their full swing, and are so constructed as to be handled with the greatest ease and rapidity, there being nothing too heavy or cumbersome about them. At the same time every part is perfectly solid and strong.

Messrs. W. H. Willard & Co., No. 529 Main street, Worcester, Mass., handle electrical goods and materials of all kinds, manufactured by the leading and most popular electrical supply concerns.

Messrs. W. C. Young & Co., the well-known lathe manufacturers of Worcester, formerly located at No. 19 Church street in that city, have moved into larger quarters at No. 15 Hermon street. The manufacturing equipment of the new shops is now more than doubled and most of it is improved machinery.

The American Bell Telephone Company has just issued its statement of the output of telephones for the month ending August 20, compared with the output for the corresponding period of last year. The subjoined statement shows a large number of returned instruments, which the Bell Company attributes in a great measure to the action of the City Council of Evansville, Ind., in having caused the temporary suspension of all exchange service by cutting the wires and poles of the telephone company, as a result of the application of the "Indiana law," thus necessitating the return of all instruments. The following is the statement:

August.	1886.	1885.	Increase.
Gross output	3,047	2,009	1,038
Instruments returned	2,763	2,553	210
Net output	284	*544	828
Dec. 21 to Aug. 20.			
Gross output	27,961	22,204	5,757
Instruments returned	13,407	17,350	†3,943
Net output	14,554	4,854	9,700

Comparison with previous months:

	Aug.	July.	June.	May.	April.	March.
Gross	3,047	3,279	4,581	4,551	3,677	2,819
Returned	2,763	1,382	1,216	1,359	2,499	1,232
Net	284	1,897	3,365	3,196	1,178	1,587

*Net loss. †Decrease. W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, August 28, 1886.

While in Cincinnati some days ago I visited the establishment of the Standard Electrical Works and found Vice-President Cherry well satisfied with the condition of trade in general. In telegraph and telephone apparatus and general line supplies, trade is above the average, while with the Hess fire-alarm and guest call they are just now experiencing quite a boom. I am happy to state that Mr. Cherry has about recovered from the recent indisposition which gave his many friends so much anxiety. That the recovery may prove a permanent one will be the wish of all his acquaintances.

Some time ago, as you are well aware, Messrs. C. E. Jones & Brother were burned out. Their misfortune necessitated their seeking new quarters, and they determined to construct a building which should be planned to meet their special requirements. Having found a suitable location at 55 and 57 Longworth street, they partly erected and partly remodeled a handsome four-story and basement structure, arranged as follows: Basement—used for stock and storage; First floor—in front, general business offices and store; back of store, stock room. In this room is located the dynamo for lighting the building throughout with incandescent lamps. At the rear of this floor is the receiving and shipping department, and adjoining the latter is a very complete and expensively equipped electrical testing room. The electrical testing apparatus is placed on a column of solid masonry built up from the ground and not in contact with the building. It is impossible, therefore, for the delicate testing instruments to be affected by the vibrations of the building. The second floor is used as a general machine shop. This department is equipped with the best and latest machines and tools known to the trade, and thorough system is observed everywhere. On the third floor are the foundry and buffing rooms, finishing rooms, plating room, etc. The fourth floor is given up to stock and storage. This firm, besides being manufacturers and general dealers in telegraph and electrical supplies, make a specialty of model and experimental work. Their reputation for this class of work is established and their facilities unexcelled. In fact, it is my belief that they have talent and facilities in this special department equal to any similar establishment in the United States. The business of this firm is in a prosperous and satisfactory condition, and the handsome proportions to which it has attained are due to the united efforts of Mr. C. E. and Mr. W. H. Jones, the former in the mechanical and electrical and the latter in the business departments. Their catalogue will be sent to any address on application.

The Cincinnati Electrical Company is a young and pushing firm, with offices at 15 and 16 Glenn Building, and its factory in course of erection. Mr. S. P. Peabody, Superintendent of the Columbus and Cincinnati Midland R. R., is the president; G. F. Belden, of the Bart and Hickox Rubber Company, is vice-president; J. H. King, of the carpet firm of G. F. Otte & Co., is the secretary and treasurer; and Mr. H. B Cox is the electrician. Mr. Cox tells me that it is his aim to exercise his inventive faculties entirely in the direction of useful and salable electrical specialties, and that some of these are all ready to be put upon the market. It is probable that the first of Mr. Cox's inventions to be offered to the public will be his electric bell cord and whistling system for use on railway trains, and his gelatine battery. The gelatine battery possesses some peculiar properties, and electricians will be anxious to see it subjected to the severest tests. This battery is the result of a demand for a battery which cannot slop over, for use on railway trains. As the solution in this battery is a semi-solid, the object sought to be accomplished is attained; in fact, Mr. Cox assures me that it will work as well upside down as otherwise, and I do not see why it should not, as it is impossible for the solution to run, although the jar containing it is coverless. I shall keep you fully informed of Mr. Cox's inventions as they are developed.

Lane & Bodley find business fair in their engine department. They build a thoroughly good engine, and one with which the buyer is usually satisfied. Their long experience in this line is shown by the excellence of their product.

A. L. Ide & Son, of Springfield, Ill., have shipped one of their latest improved high-speed automatic engines of 50 horse-power, with horse-power indicator, brake and tachometer attached, to the exposition which is being held in Cincinnati. They have also shipped a 50 h. p. engine to the Union Iron Works, San Francisco, Cal., for exhibition at the Industrial Fair, which opened on Aug. 24. Mr. Ide informs me that there are over 200 of his make of engines now in use and giving satisfaction. The J. N. Raymond Lead Works, of Chicago, have lately purchased an Ide engine; also the Medical and Surgical Sanitarium, of Battle Creek, Mich.

The American Electric Manufacturing Company, of Chicago, Mr. D. S. Foote, manager, is now in larger and more convenient quarters at 117 and 119 Lake street, as was mentioned by me soon after their removal. This company does a very satisfactory business in house and hotel annunciators, elevator calls, speaking tubes, burglar alarms, watchmen's detectors, telephone and general electric supplies. One of their specialties is an electric clock

for use in factories and workshops to automatically signal the commencing, noon and quitting hour.

Synovial oil is a lubricant for dynamo machines which has received the indorsement of such firms as the Western Electric Company and the United States Electric Lighting Company. It is claimed for their oil that it never gums, that by refiltering it can be used continually, and that it does not lose its lubricating properties. Mr. S. Taussig, agent, 39 River street, Chicago, will be glad to furnish further information.

A local paper has the following about some well-known Chicagoans who were formerly operators :

There are quite a number of old telegraph operators who have gotten rich on the board of trade. A. H. Bliss is probably one of the best known. He is a fat and jolly scalper who can yell like a Comanche, but who is believed to be good for $200,000 and weighs about two hundred and fifty pounds. H. E. Wiley, who has started the Imperial grain and stock exchange in the Imperial building, is another. He began business under the style of Wiley, Strawbridge & Co., and did around at the Grannis building the largest blackboard business of any of the firms. He now has in the Imperial building the largest public grain and stock exchange in the city. He is probably making as much if not more money than Bliss. He is one of the youngest of the very rich "bucket-shop" clique. There are a half-dozen other telegraphers who have made themselves wealthy in trade. The unfortunate Pitcher was a telegraph operator before he became rich as partner of D. H. Denton. W. A. K.

THE TELEGRAPH.

T. M. B. A.—One dollar is due Sept. 1 on assessment No. 200, arising from the deaths of Leonard Whitney and Wm. E. Vernetson. This assessment is payable from members holding certificates up to and including No. 5,459.

The Preservation of Telegraph Poles.—It is stated that in the English Government contracts the only timber now employed for telegraph poles is the Baltic red-wood, well seasoned and then creosoted. To obtain the specified quantity of 10 lbs. of creosote injected per square foot, the fine skin which grows underneath the bark must be carefully removed by planing. The processes which require the employment of salts of zinc, copper or mercury have fallen into disuse, mainly on account of the solubility of these salts, and also owing to the rapid corrosion which they caused in the reservoir and apparatus used for injection.

To Expedite Police Work.—The first steps are now being taken toward putting into operation in New York the signal and patrol wagon system that has proved so successful in Chicago, Milwaukee and St. Louis. It comprises two features—communication and transportation. By the use of the signal box placed at each post in a precinct, the patrolman is enabled to communicate directly with the station house and summon help when necessary. The patrol wagons are built after the pattern of the insurance patrol wagons and are supplied with stretchers, handcuffs, "come alongs," medicine and chests, and are capable of carrying comfortably twenty-six men to any point in the precinct on a precinct call and to any part of the city on a general alarm. These wagons are drawn by a pair of horses. By means of the rapid transportation a body of five hundred men can be concentrated at any point in the city in ten or fifteen minutes.

THE TELEPHONE.

Long-Distance Telephony.—According to report, Dr. Lucien C. Rose, of Ohio, has sailed for Gothenburg, Sweden, where arrangements have been made for a public test of his instrument, and his trip abroad is to enable him to be present at the test. Dr. Rose claims to be able to speak and hear with ease and satisfaction with his instrument over a distance of 2,500 miles.

New England Telephone Company.—A director of this company stated recently that the next two quarterly dividends—for the quarters ending Sept. 30 and Dec. 21—would be 1 per cent. each, and that the company is doing an extensive summer business. The net earnings for July, just made up, exceed any previous month since the consolidation. The company has just leased a special copper wire to a Boston firm between Boston and Lowell at an annual rental of $600. Additional copper wires to Worcester and Portland work admirably, and are doing a large business.

THE ELECTRIC LIGHT.

Evansville, Ind.—A paragraph in a recent issue referred to the employment of the Thomson-Houston dynamos in the station of the Evansville Gas and Electric Light Co. This was an error, as the concern is a very successful Brush company.

Owen Sound, Ont.—The Owen Sound Electric, Illuminating and Manufacturing Company is operating two 40-arc Thomson-Houston dynamos, and intend putting in two 250 light incandescent machines. Mr. Wm. Robinson is president and Mr. John Parker treasurer of the company.

Mr. David Bremner, an assistant electrician in the service of the Brush Electric Light Corporation of London, is at present in Uleaborg, Russian Finland, superintending an "installation" of the electric light in a large residential hotel. This is said to be the most northerly installation which has yet been attempted.

The Domestic Heating and Illuminating Company has been organized at Chicago with a capital stock of $6,000. The incorporators are Charles I. Wickersham, Charles G. Ames, and Alfred D. Eddy.

Clinton, Ia.—A Thomson-Houston plant has just started operations with 25 arc and 24 incandescent lamps in circuit. The local *Sunday News* says that "everybody is satisfied with the light, and are free to state that it far surpasses their most sanguine expectations, and are proud of the plant as constructed, believing it to be one of the finest in the country."

Binghamton, N. Y.—The People's Electric Lighting Company has been reorganized under the name of the Brush Swan Electric and Power Company, with a capital of $100,000. The directors are H. G. Jackson, F. E. Ross, John Rankin and Clark E. Otis, of Binghamton, N. Y. The officers are H. G. Jackson, President; Fred. Bennett, Secretary, F. E. Ross, Treasurer; John Anderson, General Manager; W. H. Packer, Superintendent and Electrician. The station is a large three-story brick building situated on South State street, and is one of the finest equipped stations in the southern tier. It contains two Armington & Sims engines of eighty horse-power and two steel boilers of ninety horse-power, with Jarvis settings, with capacity for 150 arc and 300 incandescent lamps of the Brush-Swan system. The lamps are giving the best of satisfaction under the supervision of the efficient electrician, W. H. Packer. The company is doing a fine business, and intends duplication of the plant this fall.

APPLICATIONS OF POWER.

The C. and C. Motor.—A press exhibition of this excellent little motor was given in this city on the 31st ult. It is designed especially for attachment to sewing machines, and is run by only two cells of battery. The motor, weighing only 10 pounds, was able to drive the needle easily through several thicknesses of canvas, linen and cloth, and was under perfect control of the operator. The battery employed is designed especially for convenient handling, the jars being provided with handles. The solution is made by dropping into water the chemicals made up in the shape of bricks.

Electric Launch Trial Trip.—The electric launch Volta made her first trip recently, from London to Kempton Park and back, with perfect success; the total distance covered was about 46 miles, and the stored energy was not exhausted. The company on board consisted of 14 ladies and gentlemen. This launch is somewhat larger than that which has recently been delivered to the Italian government, and which, we learn, has been used for the purpose of taking H.M. the King of Italy about the harbor of Spezzia when attending the naval reviews. The Volta is 37 feet long and 7 feet beam. She is propelled by a Reckenzaun duplex motor and gear constructed by Messrs. Stephens, Smith & Co., and a set of 61 E.P.S. accumulators. By means of an ingenious switch devised by Mr. Reckenzaun, her speed may be varied from 6 miles an hour to a maximum of 10 miles an hour in still water.

An Electrical Launch.—A few days ago a very interesting trial run was made on the River Cart, at Paisley, with a screw launch having electricity as the motive power, the inventor and patentee of the method adopted being Mr. William Gibson, of the Cartha Works, Paisley. The launch employed is a boat of 24 feet in length and 5 feet 3 inches in breadth of beam, and the propelling motor is an engine of two h. p. nominal. In the course of the run a speed of about seven miles an hour was attained, and the trial was regarded in every way as satisfactory. The accumulators in which the energy was stored were placed beneath the side seats of the boat, and quite out of the view of the passengers. The current is sent through an armature, on the spindle of which there is placed square-cut gearing which reduces the velocity from 1,500 revolutions per minute to 230. This gearing is also suitable for working tramway cars, being very certain in action; indeed, the invention, it is said, can be more widely used for propelling cars than launches. The machinery can also propel either backward or forward by friction, with the armature running in the same direction.

PERSONALS.

Mr. John Thomson, the engineer of the New York Subway Commission, has resigned his position. Mr. Thomson will probably accept a similar position with the Consolidated Telegraph and Electric Subway Company.

Mr. J. D. Thomas, formerly located in this city, has just accepted the position of superintendent of the Para Rubber Shoe Company, of South Framingham, Mass. Mr. Thomas is the inventor of much valuable machinery, among which may be mentioned machines for making insulated electric, telephonic and telegraphic wire and cable.

MISCELLANEOUS NOTES.

The American Insulated Conduit Company has been organized for the manufacture of conduits, pipes, etc. The operations are to be carried on at Hempstead, L. I., and elsewhere. The capital stock is $200,000.

New Companies.—The following companies were incorporated at Chicago last week: The Musico-Electric Medical Apparatus Company; capital stock, $300,000; incorporators, David M. Alexander, Henry Plowman, Jr., and Robert M. Brett. The Electric Mail-Box Company of Illinois; capital stock, $50,000; incorporators, Francis W. Corey, Arthur F. Raze, and Charles H. Baker.

The "Volta" Prize Competition.—By a decree dated June 11, 1882, the Government of France offered a reward of 50,000 francs for the discovery of greatest value relating to the utilization of electricity for any of the following purposes: As a source of heat, of light or of chemical action; as a means of transmission of mechanical power, or of verbal communication in any form; or, finally, as a curative agent. The Minister of Instruction has now announced that June 30, 1887, will be the latest date for entering the competition, and that the prize will be awarded in the following December. The competition is open to all, without restriction, and *savants* of all nations are invited to participate in the award.

What is It?—The Tulare *Free Press* is responsible for the following marvelous tale: A very peculiar property has recently been discovered in the rock of a mountain seven miles from the town of Santa Cruz. This rock is heavily charged with electricity, and when applied to a battery was found to produce strong electric currents. A small handful of this rock applied in a battery generates sufficient electric force to operate the battery for three weeks, and appeared not to be the least exhausted of its powers. This rock has very much the appearance of ordinary soapstone, and exists in immense quantities, constituting the principal mass of the mountain. Its strange property was accidentally discovered by a man who was experimenting with mineral water on the mountain, and having occasion to use some of this rock, placed it in contact with the battery. The man who made this wonderful discovery kept it a profound secret from the world until he and one or two of his confidential friends had obtained a title to a portion of the land, paying $15,000 therefor. The present owners are now experimenting with this rock, with a view to thoroughly testing its properties.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Western Union, b 65⅛, a 66.

Telephone.—Am. Bell, b 190, a 191; Erie, b 26; Mexican, b 1¼; New England, b 40.

Electric Light.—Am. Electric Mfg., b 16.

BUSINESS NOTICES.

Kidder's Faradic and Galvanic Electric Batteries have been on the market for many years, and have become thoroughly established in reputation. We take pleasure in offering our experience of many years' use of these batteries with the most satisfactory results, as evidence of their excellence and value.—*Journal of Inebriety.*

"**There** are many made, but very few of any value," was the remark of a celebrated authority. This remark is well adapted to the many kinds of electrical apparatus, for there are many made, but when it comes to real merit and adaptation to remedial uses, the one that can always be relied on is the "Jerome Kidder" machine, manufactured at 820 Broadway, New York. It is the perfection of "means to an end," for in the many years since it was first introduced there has been constant study as to improving it.—*Pharmaceutical Record, Aug.* 15, 1886.

Magnetism in Watches.—

THE UNITED STATES ELECTRIC LIGHTING CO.

C. C. WARREN, *Manager Western Department.* 216 *La Salle Street.*

CHICAGO, Feb. 10, 1885.

Messrs. Giles, Bro. & Co.:

GENTLEMEN: I have now been carrying my watch encased in one of your Anti-Magnetic Shields for about a year, and it affords me pleasure to state to you that notwithstanding I have been very much about dynamo-electric machines during the time named, the anti-magnetic case seems to protect the watch perfectly from the magnetic influence of the machines. I have not made any special electrical tests, inasmuch as I regard the good running of the watch as all that is necessary. I am thoroughly convinced, from the effect upon my own watch, that the case is an excellent protection, and I may almost add an absolute preventive of magnetic influence from external sources to the delicate movements of a watch. My watch is a Howard watch, and during the period of two or three years previous to encasing it with your anti-magnetic case it had varied to a very great extent, and I had it demagnetized on two different occasions. I regard your case as a complete success, and if my indorsement of same is of any value, you are at liberty to use it.

Yours truly,

C. C. WARREN, *Manager Western Dept.,*
The U. S. Electric Lighting Co.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED AUGUST 17, 1886.

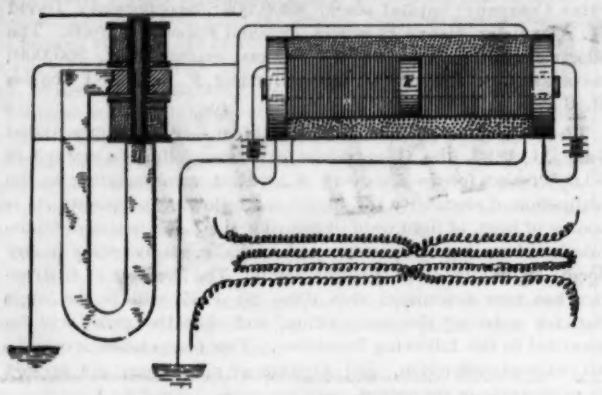
347,318. James P. Brewer and William C. Smith, New Haven, Conn. Embraces an apparatus for communicating with policemen while on their beats from a directing-station, consisting in electro-magnetically operated visual signals distributed throughout the field under surveillance, a common directing-station, and electrical connections between such signals and the directing-station.

347,319. Signaling Apparatus; Gilman W. Brown, West Newbury, Mass. Consists in a series of discs rotated at a continuous rate by a suitable time-movement, each adapted to close and break an electric circuit a given number of times during a complete rotation, each closure of the circuit causing a blast of a whistle included in said circuit, a laterally-movable contact-arm included in said circuit and adapted to be moved to make contact with either of said discs, a dial or plate marked to indicate cardinal points of the compass, and the principal intermediate points and devices for moving said contact-arm controlled by a combined handle and pointer which is adapted to revolve over said dial, the arrangement being such that when the handle points to a given subdivision of the dial the contact-arm is in position to co-operate with the circuit closing and breaking disc, which is formed to give the signals belonging to that subdivision, so that by keeping said handle or pointer over that part of the handle that indicates the course of the vessel the proper signals will be automatically given.

347,374. Telephone Apparatus; Thomas J. Perrin, Brooklyn, N. Y., assignor, by mesne assignments, to the National Improved Telephone Co., New Orleans, La. He employs a peculiar arrangement of induction-coil, shown in the cut, involving more than one primary circuit, and so constructed that currents of different tensions are thrown upon the line to act upon the receiver at a distant station. This receiver is constructed with more than one coil—that is, with a coil for each of the transmitted currents—adapted specially to respond to its particular current and not to the others.

347,399. Electric Clock and Indicating System; Thomas C. H. Vance, Louisville, Ky. Consists of an electric circuit and means for varying the strength of the current im-

pulses therein, or their equivalents, time and indicator mechanisms and electro-magnets included in the circuit, and differently adjusted armatures, for operating the time and indicator mechanisms, the object being to combine time and weather indi-



347,374. TELEPHONIC APPARATUS.

cating mechanisms, so as to be simultaneously or successively operated by the same electric circuit.

347,440. Voltaic Battery; August F. W. Partz, Philadelphia, Pa., Assignor to the Partz Electric Battery Co., of same place. See description in THE ELECTRICAL WORLD, July 31.

347,454. Telegraph Wire and Insulator Fastening; John Wilson, New York, N. Y. The tie-wire is in a groove, which is at right angles to the groove containing the conducting wire.

347,528. Illuminated Clock Hand and Dial; Alfred Speer, Passaic, N. J. Consists in combining, with each of the hands of a clock, a series of lights or lamps, preferably incandescent electric lamps, so as to be carried by the hands; also in the combination, with the hands and lamps, of reflectors arranged to throw the light outward from the hands, and to render all the light of the lamp available.

347,571. Indicating Apparatus; 347,572. Electric Clock System; Charles L. Clarke, E. Orange, N. J. 1. Consists in applying to a circuit-closing point adapted to be moved in one direction or the other by variations in the force or pressure to be limited two contact-points which are adjustable in their positions with reference to the circuit-closing point. Two conductors leading therefrom, respectively, include electro magnets adapted to complete permanent shunt-circuits around the points, and other electro-magnets adapted to respectively operate devices for indicating whether the force is in excess or at a minimum. 2. The object is to provide means for causing the successive impulses to advance the clock-movements the required distance to insure that there shall be no excess of movement, and that the movement shall be as perfectly locked as possible at all times, and to maintain the circuits and circuit-connections in proper condition. The device is shown in the cut.

347,589. Automatic Signal Level Indicator and Controller; John J. Ghegan, Newark, N. J. Consists in providing a float of magnetic material in combination with a magnetic circuit controller; so that, as the level of the liquid approaches a given point, a signal is given or other translating devices in the circuit are operated.

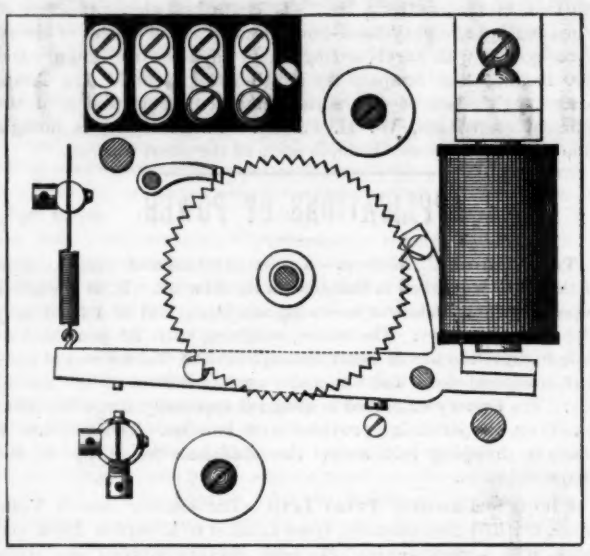
347,592. Therapeutic Electric Belt; Ira Gray, San Francisco, Cal. Consists of improvements upon his patent 246,387, Aug. 30, 1881.

347,602. Telegraph Pole; Hiram C. Herron, Cleveland, O. The pole is provided with a wire holder or frame adapted to slide upon the pole.

347,625. Wire Joint; Charles McIntire, Newark, N. J. The cuts fully explain the idea. The wires are inserted in two connecting tubes and then twisted.

347,628. Electric Train Controlling System; Fletcher J. McQueen, Ocala, Fla. Consists in a recording instrument comprising a clock-work and revolving graduated dial, a stylus or marking device held out of action by an electro-magnet included in an electric circuit and brought into action by the breaking of such circuit through the medium of a moving railroad train at any distant point or station.

347,634. Automatic Electric Signal; Henry C. Nichol-

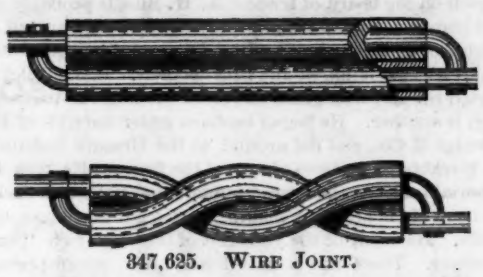


347,572. ELECTRIC CLOCK SYSTEM.

son, Mount Washington, O. The object is to operate the hammer by alternate electrical currents. It consists of a battery, an electro-magnet coil in circuit therewith, an oscillating core suspended in the coil and between the poles of fixed magnets, and a reversing-arm which moves a slide between opposite polar contacts, thereby automatically reversing the terminal connections of the coil.

347,635. Telegraph Insulator; John O'Brien, New York, N. Y., Assignor to William Brookfield, of same place. It is provided with a line-wire lug having a convex supporting surface for said wire.

347,642. Electric Current Converter; Robert A. Ripley, New York, N. Y. Consists in inducing in one or more stationary coils, by means of the primary current, currents of the desired electromotive forces and combining with such inducing apparatus means for rectifying, with respect to the working or useful circuit, the alternating or reversed currents produced in these coils so as to supply the working circuits with practically continuous currents of unchanging polarity.



347,625. WIRE JOINT.

347,707. Electro-Magnetic Valve; Milton W. Grovensteen, New York, N. Y. The magnet is inclosed in an airtight chamber which has a connection through said valve.

347,752, 347,753. Railroad Signaling Apparatus; William Vogel, Chicago, Ill., Assignor to the Consolidated Railway Telephone and Signal Co.

1. Consists of means whereby collisions at the crossing shall be avoided by causing the train which clears the crossing first automatically to set the electrical apparatus located adjacent to the crossing in a manner that will cause any other train or trains approaching the crossing to be warned of the position of the first train, and whereby the passage over the crossing of any train without being signaled will be a reliable indication to it that it has the right of way and may proceed without danger.

2. The object is to permit the prevention of collision between trains moving toward each other on the same track by causing a warning-signal to be transmitted automatically from the locomotive of one train to that of the other from certain predetermined points. Consists of details of mechanical construction.

347,754. Battery and Battery Plate; Henry Woodward, Shepherds Bush, Eng. The leading claim is a battery in which cast-iron is employed as one of the elements, the other element being a porous one made of zinc cast in connection with granular salt.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.

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WANTED.

Competent man seeks situation, Electrical or Mechanical Work, Arc or Incandescence Installation. Take charge of Electric Light Plant, any system; Repair Dynamos, Lamps, etc. Further particulars personal. Address C. E., Care THE ELECTRICAL WORLD, New York.

FOR SALE.

Twenty-five pounds of No. 33 B. & S. Gauge German Silver Resistance Wire, English make, and 100 or more Magnets, 1,200 ohms each; size of core, ¾ diameter; length, 2 inches; diameter of head, 1¼ inches. A. S. BUNKER, 280 Common street, Lawrence, Mass.

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DYNAMO and Large Tanks for the Electro-Deposition of Copper.

Will sell very reasonably, or will rent the plant to any one who desires to employ it for the production of useful and saleable articles.

For full particulars, address "K.," Care THE ELECTRICAL WORLD, New York.

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Burglar Alarm Window Springs, per doz.	$1.44	New Short Line Morse Tel. Inst., per ½ doz.	$13.50
" " Door " "	1.50	Novelty A Battery.....(doz. lots), each.	1.15
Push Buttons, Walnut, Ash, etc., per 100.	8.00	Novelty Disque Battery (case lots 50), each.	55
Hollow Base Switch, Walnut, etc., per 100.	20.00	Novelty Disque Battery Zincs (the best), per 100.....	50.00
Floor Push.....per doz.	3.60	Morse Telegraph Outfit, com. with battery.	3.00
Four-Point Needle Annunciator, with Bell.	5.00		

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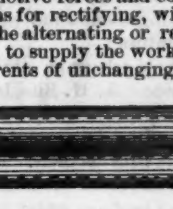

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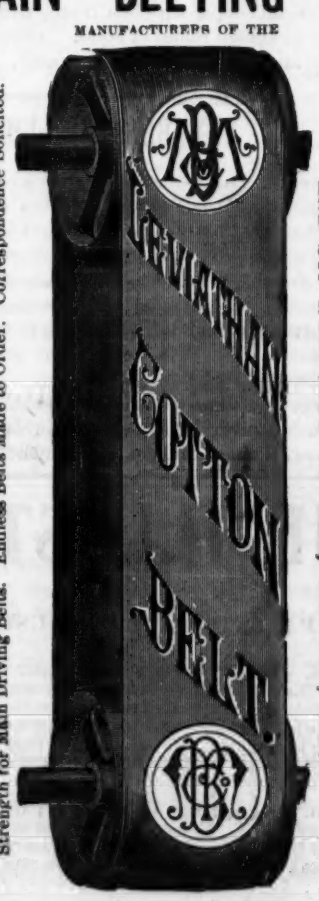

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